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ABSTRACT

On an international comparison basis, data derived from censuses in 1950 and 1960 indicated a significant international correlation, but a weak intranational relationship between productivity and formal education. Meaningful correlations that exist for some industries across countries lead to the conclusion that there exists a relationship between productivity and education for each industry separately. The major determinant in the variation of productivity is the occupational distribution in the total labor force rather than the variation in the years of schooling of the same occupations. Correlations between the proportion of people with more than a secondary education, with productivity are most significant. Formal education, as a derived demand, is a misleading indicator of productivity, due to the importance of other modes of occupational training. The present use of educational distributions for analysis and planning must be reviewed, incorporating a wide range of variables in order to arrive at a correct appraisal of educational data. Numerous tables present the data. (Author/AG)

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THE RELATIONSHIP BETWEEN PRODUCTIVITY AND THE FORMAL EDUCATION OF THE LABOR FORCE IN MANUFACTURING INDUSTRIES

BY

MANUEL ZYMELMAN

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Manuel Zymelman
Cambridge, Massachusetts
1970

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The Relationship Between Productivity and the Formal Education of the Labor Force in Manufacturing Industries

Introduction:

The planning of manufacturing industries has become in the last few years a multifacet task encompassing not only the traditional areas such as engineering, marketing, labor relations and so on, but also areas hitherto considered to be on the fringe of direct production, such as education.

The concern of planners with education came through the backdoor of planning and was introduced, surreptitiously at first, by economists who despaired at the failure of their attempts to explain the growth of national economic product by relating physical capital and labor inputs in the traditional manner, and by educators who at last realized their dreams of incorporating educational planning into the more easily accepted economic planning.

The main impulse, however, came from the realization that it is simply not sufficient to provide a country with the necessary physical equipment to induce rises in productivity and production, and that the existence of the human resource is a necessary, although not sufficient, condition for making rational use of the equipment.

The post Second War period provides the best example of the necessity for complementing human with physical resources. The nations that benefited the most from foreign aid, such as countries under the Marshall Plan and Japan, were those nations where the adequate human material was available in the form of skills and education. Many other countries that lacked these elements learned the hard way that it is useless to plan for industries that require many engineers and technicians when schools for engineers and technicians do not exist.

The concern with matching the human resource with physical resources is reflected in the official position of the United Nations Industrial Development Organization, a major international planning office: "The assessment of the skills required at all levels deserves continued deep study.....There is urgent need for specific inquiries into the needs for all kinds of manpower.....To include manpower planning and programming experts into industrial development missions organized and supported by UNIDO (Ad-Hoc Meeting of experts, UNIDO, New York, May 1967).

Concomitant with, or even preceding this concern of planning organizations, was the resurgence, with a vengeance, of education as a major topic in economic writings and economic planning.[1]

A major part of the work of economists in the field of education dealt with the impact of education on economic growth and development. The approaches to the problem varied from a general defense of education as a gestator of inventions and innovations in society "a la" classical and "neoclassical" economists, to the "precise" econometric measurement of residuals and rates of return of the 1950's and 1960's.

For example, Mercantilists spoke glowingly about skilled manpower, "their art and ingenuity" as a major factor contributing to the growth of wealth. Adam Smith, in the best Scottish Tradition, praised education and was the first to consider education an investment. "The improved dexterity of a

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1. A Selected Annotated Bibliography in the Economics of Education, Pergamon Press, London 1966 by Mark Blaug, contains 792 items of which only about 60 were published before 1955.

workman may be considered in the same light as a machine or instrument of trade."[2] Ricardo and Malthus prophetically looked at education as a means of inculcating habits to limit family size and thereby increase income per capita. Other English economists[3] such as Mill and McCullock proclaimed education a major force in shaping a desirable society "prone" to development.

A major analytical thrust was given by Marshall, who considered education a "National Investment" and a "good" investment as well, since "No change would conduce so much to a rapid increase of material wealth as an improvement in our schools.... the wisdom of expending public and private funds on education is not to be measured by its direct fruit alone. It will be profitable, as a mere investment, to give the masses of the people much greater opportunities that they can generally avail themselves of."[4] He was also the first to relate education to the demand for skills and to the change in skill requirements over time.

The pioneering quantitative work came from the Marxist quarter where S. G. Strumilin[5] in 1925 tried to analyze the economic effect of education.

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2. The Wealth of Nations 6th edition, Edwin Cannan ed., Book I, p. 264.

3. For an excellent review of the position of English economists on education see John Vaizey, The Economics of Education. The Free Press of Glencoe Inc., Great Britain 1962, Chapter I.

4. "Education and Invention" Alfred Marshall - Principles of Economics quoted by Charles S. Benson ed. Perspectives on the Economics of Education, Houghton Mifflin Co., Boston 1963. p. 82-83.

5. "The Economic Significance of National Education" reprinted in The Economics of Education edited by E.A.G. Robinson and John Vaizey, S. Martins Press, New York 1965.

A major influence in the attempts to quantify the importance of education were the tools introduced by Irving Fisher in his capital theory - These were the notions of capital stock, income flows, and the rate of return.

On the micro-economic level there were studies trying to relate earnings to years of schooling. The works of Walsh,[6] Friedman and Kusnetz[7] prepared the ground for the many other works that appeared in the 1950's and 1960's, such as the works of Schultz,[8] Becker,[9] Blaug,[10] Mincer,[11] and many others.[12] The implications that can be derived from these studies for the importance of education to economic development can be summarized as follows:

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6. J. R. Walsh "Capital Concept Applied to Man" Quarterly Journal of Economics, February 1935.

7. Milton Friedman and Simon Kusnetz. Income for Independent Professional Practice, New York, National Bureau of Economic Research, 1946.

8. Theodore Schultz. The Economic Value of Education. Columbia University Press 1963.

9. Gary S. Becker. Human Capital. Princeton University Press, 1965.

10. Mark Blaug, "Private and Social Rates of Return to Education". Manchester School. September 1965.

11. Jacob Mincer. "On the Job Training Costs Returns and Some Implications" Journal of Political Economy, Supplement, October 1962.

12. For a bibliography of the more recent work see "Symposium on Rates of Return to Investment in Education", The Journal of Human Resources, Vol. II, N3 Summer, 1967.

a) Wherever relative earnings reflect the free interplay of market forces - a very iffy proposition - we may expect that a higher education,[13] with its corresponding higher earnings, reflects higher productivity from the national point of view.

b) Rates of return from investment in education, however measured, compare favorably with rates of return from other types of investment.

Conclusions to the effect that education is responsible for a large proportion of the rate of economic growth were also provided from other quarters.

The appearance of "The Residual" in a flourishing economic literature based on the works of Abramowitz,[14] Solow,[15] Aukurst,[16] and Kendrick[17] prompted economists to try to label the residual, hitherto known as "the measure of our ignorance,"[18]

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13. A pernicious side effect of this plethora of publications was, unwillingly, to submerge many human aspects under the general title of education. The term "education" became an all-embracing concept in which the meaning of formal and informal education, learning by doing, learning by osmosis from environment, tradition, value, systems, social structure and so on, became undistinguishable one from another.

14. M. Abramowitz. Resource and Output Trends in the United States Since 1870, National Bureau of Economic Research, Occasional Research Paper 52, New York, 1956.

15. Robert Solow. "Technical Change and the Aggregate Production Function" Review of Economics and Statistics, Vol. 39, August 1957.

16. O. Aukurst. "Investment and Economic Growth" Productivity Measurement Review, Feb. 1959.

17. John W. Kendrick. Productivity Trends in the United States, Princeton University Press. NBER, 1961.

18. M. Abramowitz, Ibid. p. 11.

and lay claim to it. The attempts ranged from making estimates of the contribution of everything, including education, to physical production,[19] to attributing the unexplained rise in productivity to such esoteric influences as "learning by Doing"[20] and the"Horndal Effect".[21]

Another tack, trying to relate education and National Income per capita, was attempted mostly in order to determine relationships needed for planning purposes. Many of these planning models[22] assume fixed coefficients between manpower and income, and manpower categories are defined according to educational attainments, thus providing fixed coefficients between income and different educational levels.

Others embarked directly to find the relationship between income and education. In general the approach consisted of correlating income with current or lagged lavels of educational

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19. See Edward E. Denison. "Measuring the Contribution of Education (and the Residual) to Economic Growth" in The Residual Factor and Economic Growth. OECD, Paris, 1964.
T. W. Schultz. "Capital Formation by Education" Journal of Political Economy. Dec., 1960.
Zvi Griliches. "The Sources of Measured Productivity Growth in U.S. Agriculture 1940-60" Journal of Political Economy XXI (4) 1963.

20. Kenneth Arrow. "Learning by Doing" Review of Economic Studies XXIV June, 1962.

21. This name was derived from the Steel Mill in Horndal, Sweden. A rising trend in labour productivity was noticed at this particular mill with no new investment. (Commented by Erik Lundberg in Productibitet och Rantibilitet, Stockholm 1961).

22. Jan Tinberge and H. C. Bos. Econometric Models of Education, OECD, Paris, 1965.
H. Correa, The Economics of Human Resources. Amsterdam, North Holland Publishing Co., 1963.
Herbert S. Parnes, Forecasting Educational Needs for Social and Economic Development. OECD, 1962.

activity on an intertemporal[23] or on an intercountry comparison basis. In the latter type of study the authors try to find a relationship between stages of development and enrollments in primary, secondary, and university levels. (These are, presumably, proxies for education).

Harbison and Myers,[24] for example, report good correlation coefficients between GNP/capita and different levels of enrollments. Lewis[25] found relationships between secondary education and development. Peaslee[26] found that a threshold of 10% of primary school enrollments, as a proportion of total population, is needed to achieve any "significant" rate of growth. Kaser[27] tried to relate levels and growth rates of National Product per Capita to quantity and quality of education.

McClelland[28] investigated the relationship between levels of development and the educated stock, and also between the Achievement Level with higher levels of education.

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23. T. W. Schultz, "Education and Economic Growth" in Yearbook of the National Society for the Study of Education 1961.
Seymour Harris, The Market for College Graduates (Harvard University Press, 1949).

24. F. Harbison and C. A. Myers. Education, Manpower and Economic Growth. McGraw Hill, N. Y., 1964.

25. W. A. Lewis. "Secondary Education and Economic Structure" Social and Economic Studies University of West Indies, Jamaica, Vol. 13, June, 1964.

26. Alexander L. Peaslee, "Primary School Enrollments and Economic Growth" Comparative Education Review, Feb., 1967.

27. M. C. Kaser, "Education and Economic Progress Experience in Industrialized Market Economies" in E. A. G. Robinson and John Vaizey. op. cit.

28. David C. McClelland, "Does Education Accelerate Economic Growth?" Economic Development and Cultural Change Vol. XV, No. 3, April, 1966.

The introduction of lags in the analysis by Curle, Anderson and Bowman, and Kaser[29] was an attempt to relate enrollments and expenditures of education of one period to increased rate of growth or income per capita of a later period.

All of these studies and similar ones relating expenditures of education and economic growth[30] merely show that increases in educational expenditures or enrollments are probably a concomitant of economic growth.

The results of these studies, however, fail to come to grips with the fundamental questions:

a) Is education a necessary pre-condition for development or a by-product of economic development?

b) To what extent do ideologies and social norms and values shape the levels of education independently of the strict influence of economic forces (if economic forces do

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29. A. Curle, "Education, Politics and Development" Comparative Education Review VII, 1964.
M. J. Bowman and C. A. Anderson, "Concerning the Role of Education in Development" in C. Geertz ed. Old Societies and New States, The Free Press, 1963.
M. C. Kaser, op. cit.

30. F. Edding, "Expenditures on Education Statistics and Comments" in E. A. G. Robinson and John Vaizey eds. op. cit.
Daniel Blot and Michel Debueauvais, "Educational Expenditures in Developing Countries: Some Statistical Aspects" in Financing of Education for Economic Growth. OECD, Paris, 1966.

indeed exist independently of social and ideological forces).

c) Assuming that there is an association between some measure of economic progress and education, can this relationship be used for policy making? or is this relationship between these macro-variables, income and education, merely a reflection of the interaction of variables of a lower order, and therefore, to influence the outcome of this interaction, do we have to identify and determine the relationship between these micro-variables.

This paper will deal mainly with problem c, but the results touch indirectly on questions a and b.

The Relation Between Productivity and Education

Most studies dealing with this topic have used, until recently, enrollments and expenditure data as proxies for the actual educational attainment of the labor force. The reason was simply the absence of detailed data on occupations, education and industry.

The data now available,[31] although still representing a small number of observations, allows a limited but useful analysis of the question of the relationship between productivity and education. The basic hypothesis tested in this study is: Is there a relationship between productivity (value added per employee) and the formal educational level of the labor force?

The data

Most of the data was derived from the available Censuses of 1950 and 1960. A cross classification of education by industry is not available; therefore the educational level in a given industry had to be derived from the cross classifications of occupations by industry and education by occupation.

The educational distribution of the labor force in an industry was obtained by multiplying the vector

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31. M. Horowitz, M. Zymelman, E. Herrnstadt, Manpower Requirements for Planning, Statistical Tables, Northeastern University, Boston, Mass., December, 1966.

distribution of occupations by the matrix of educational distribution of occupation.

$$E = O_i \times [a_{ie}]$$

i = occupation
e = education

The classification of occupations has to be at least at the three-digit level, otherwise the results may be misleading. If we take a group like Professionals and Technicians in a specific industry and apply to it the average educational level of Professionals and Technicians of the country as a whole, we are probably committing a gross error since the average educational level of this group is weighted by the distribution of the different types of professionals and technicians in the country. This distribution may not be relevant at all to the sector of industry in question. Take for example a sector like Construction. Most of its professionals and technicians are engineers, draftsmen, surveyors and so on. On the other hand, the average for the country includes physicians, librarians, nurses, etc. It would be sheer coincidence if the educational level of the group in construction resembles that of the country as a whole. Therefore, some of the results obtained from using a one digit occupational classification to relate productivity to education (see for example the work of P. R. G. Layard and J. C. Saigal. Educational and Occupational Characteristics of Manpower: An International Comparison British Journal of Industrial Relations, Vol. IV, July 1966) have to be taken with a grain of salt.

Even by taking a three digit or higher level of occupational classification we assume that the educational distribution of an occupation is similar in every industry. This

may not be the case; the electrical industry, for example, may use electricians who are more educated than the electricians employed by the textile industry. This objection weakens as the classifications become finer.

Comparability of data

For international comparisons the data has to be standardized. The problem of standardization of measurement of productivity and occupations has already been discussed by the author.[32] The problem of standardization of the classification of educational levels is even harder to solve. The data as presented in the Census for the countries under consideration that have both occupation by industry and occupation by education classifications is classified according to the following levels:

Country	Classification Levels Years of Schooling
Argentina	no schooling/1-6/7-11/12/13-15/16+
Canada	1951 and 1961 0-4/5-8/9-12/13+
Japan	1950 0-3/4/5-6/9-11/12/13-15/16+
United States	1950 0-8/8/9-11/12/13-15/16+
United States	1960 0-5/5-8/9-11/12/13-15/16+

32. See M. Zymelman "Skill Requirements in Manufacturing Industries" United Nations Economic and Social Council E/C. 5/112, 1966 and "Productivity, Skills, and Education in Manufacturing Industries" United Nations Industrial Development Organization ID/WG. 3/DP/10 May 1967.

Highest Educational Level Achieved

Norway 1960 Lower Vocational Training/Higher Vocational Training/University/Other

Germany 1957 Without Formal Training/ Apprenticeship Program/ Vocational Schools/University/

Yugoslavia 1961 Without Schooling/4-7 Grades/ Elementary/ Lower Vocational School/Vocational School for High Skills/School for Technicians/Sub University/University

Netherlands 1960 Elementary School/Advanced Primary Education/Medium Level/Higher Medium Level/Semi High Level/University/Graduate School

France 1962 Primary School Diploma/B.E.P.C. Diploma/ Secondary School Diploma/University Diploma

Japan 1960 No Schooling/Elementary School/Junior High School/Senior High School/Junior College/ University

Terminal Education Age

United Kingdom 1951 and 1961 Less than 15 years/16-19 years/ 20+ years

The first step was to express all these classifications in approximate years of schooling. The conversion was done using UNESCO's World Survey of Education, N. Y. IV 1966, and the results can be seen in Appendix 1. The translation of levels of schooling and terminal age of education into years of schooling is only part of the problem. Assuming - and this assumption is very dubious - that quality of education is uniform across national boundaries, and that a year's schooling in one country is similar to another, we are still faced with

the problem of how to decide on the precise years of schooling when the educational level is expressed in "highest level completed", or in a given range.

For example in the cases of Japan 1960, France 1962 and Norway 1960, the levels of schooling are expressed as the highest level achieved: elementary school, secondary, etc. Now, this does not mean that a person who appears as having only an elementary education could not have gone to school three more years and dropped out before graduation from secondary school. He could have quit school in any of the years between the first and the last year of the next level in which he appears as a member. The same can be said when the data is presented in range form as in Canada, Japan 1950, United States and so on. If 30% of the population in a country has 0-8 years of schooling and 20% in another finished 6 years can we conclude that one country's level of education is higher than in the other? The answer is NO. It will depend on the distribution over the range. Merely fixing the midpoint of the range as benchmark is as arbitrary as fixing it at any other point. This is why it may be misleading to use a single dimension to measure education. Averaging of years of schooling, especially when doing it over wide ranges such as elementary and secondary school, elementary and university, etc., assumes that a year in a 4th grade is equivalent to a year of postgraduate study. Also to affix arbitrarily a weight to different types of education[33] does not have any factual basis.

Since no single measure can be used, and classifications differ between countries, it is best to use cumulative frequencies having in mind that too much aggregation brings us to the pitfalls mentioned above.

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33. Harbison and Myers, op. cit. Chapter 3.

The classification that best fitted available data was: Years of schooling: 0-4/8 or less/12/12 or more/13 or more/ 16 or more/

Analysis of the data

The proposition that there exists a relationship between productivity and education of the labor force was tested with the following linear and logarithmic forms:

$$y = a + bx$$

and

$$\log y = a + b \log x$$

where y is productivity and x is the proportion of the labor force in a given level of education 0-4, less than 8 and so forth.

The coefficients of correlation, their significance and the number of variables is given in Table I.

In this first case every observation is an industry regardless of the country to which it belongs.

The strongest relationships are obtained when correlating productivity with the educational groups of 12+ years, 13+ years and 16+ years. The weakest are with 0-4 years and 0-8 years.

This first analysis would tend to show, indeed, that a higher productivity is correlated with education, especially with the proportion of people with 12 or more years of schooling. However, this type of analysis can be misleading.[34]

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34. See Edwin Kuh, Capital Stock Growth - A Micro Econometric Approach. M.I.T. North Holland Publishing Co., Amsterdam 1963, Chapter 5.

Therefore a similar correlation was run using each country separately as the sample from the universe. The results of the linear and logarithmic form can be seen in Table II.

In this case, because it was possible, we use for greater reliability the original classification of each country. The results of Table II show that the correlations for each country are much weaker than the correlations of the aggregate of all countries. For example, for the U.S. correlations are weaker in 1960 than in 1950.[35] There are no meaningful correlations for Canada 1951 and Canada 1961, United Kingdom 1951 and 1961, Norway 1960, (except for the logarithmic form of the 16+ category), Yugoslavia, and Argentina. The correlations are meaningful for the 16+ category for France and West Germany. Japan shows a good correlation at various levels such as 12 and 16+.

We can deduce, therefore, that there exists a very weak relationship between productivity of an industry and the educational level of its labor force in a given country, and that correlations we obtain by combining all the countries are due perhaps to other factors not present in the equation or to the special arrangement of the data.

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35. Similar results were obtained by John K. Folger and Charles B. Ham in "Trends in Education in Relation to the Occupational Structure - "Sociology of Education, Vol. 38, Fall 1964.

TABLE I

Linear Correlation of Productivity and Education

y_{jc} = productivity in industry j in country c

x_{ijc} = proportion of people with level i of education in the j industry in country c

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-4	-.124	127
less than 8	-.308**	200
12	.553**	130
12+	.625**	148
13+	.627**	164
16+	.606**	182

Log. Correlation

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-4	.086	127
less than 8	-.046	200
12	.419**	130
12+	.422**	148
13+	.442**	164
16+	.551**	181

** Significant at .01 Level
* Significant at .05 Level

TABLE II

Linear Correlation of Productivity and Education

Country: United States 1950

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-8	-.492**	36
8	-.463**	36
9-11	-.124	36
12	.551**	36
13-15	.513**	36
16+	.385**	36

Log. Correlation

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-8	-.505**	36
8	-.398**	36
9-11	-.008	36
12	.569**	36
13-15	.537**	36
16+	.527**	36

** Significant at .01 Level
* Significant at .05 Level

Country: United States 1960

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-5	-.392*	36
5-8	-.397*	36
9-11	-.150	36
12	.408*	36
13-15	.279	36
16+	.204	36

Log. Correlation

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-5	-.427**	36
5-8	-.362*	36
9-11	-.115	36
12	.526**	36
13-15	.345*	36
16+	.366*	36

** Significant at .01 Level
* Significant at .05 Level

Country: Canada 1951

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-4	-.070	22*
5-8	-.194	22*
9-1[illegible]	.039	22*
13+	.155	22*

Log. Correlation

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-4	-.160	22
5-8	-.188	22
9-12	.114	22
13+	.273	22

** Significant at .01 Level
* Significant at .05 Level

Country: Canada 1961

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-4	-.173	25
5-8	-.201	25
9-12	.186	25
13+	.174	25

Log. Correlation

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-4	-.176	25
5-8	-.166	25
9-12	.264	25
13+	.186	25

Country: United Kingdom 1951

Variable Description (x) Years of Terminal Education	Correlation Coefficient	Number of Observations
less than 15	.171	26
15	-.035	26
16-19	.020	26
20+	.050	26
not stated	.018	26

Log. Correlation

Variable Description (x) Years of Terminal Education	Correlation Coefficient	Number of Observations
less than 15	.167	26
15	-.015	26
16-19	.086	26
20+	.027	26
not stated	.053	26

Country: United Kingdom 1961

Variable Description (x) Years of Terminal Education	Correlation Coefficient	Number of Observations
less than 15	-.247	27
15	.051	27
16-19	.313	27
20+	-.056	27

Log. Correlation

Variable Description (x) Years of Terminal Education	Correlation Coefficient	Number of Observations
less than 15	-.275	27
15	.037	27
16-19	.333	27
20+	.102	27

Country: Japan 1950

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-4	-.273	30
5-6	-.478**	30
7-8	-.259	30
9-11	.484**	30
12	.406*	30
13-15	.214	30
16+	.458*	30

Log. Correlation

Variable Description (x) Years of Education	Correlation Coefficient	Number of Observations
0-4	-.461*	30
5-6	-.453	30
7-8	-.175	30
9-11	.407*	30
12	.513**	30
13-15	.209	30
16+	.645**	30

** Significant at .01 Level
* Significant at .05 Level

Country: Netherlands 1960

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Elementary School	-.309	24
Advanced Primary School	.104	24
Lower Medium School	.340	24
Higher Medium School	.496*	24
Lower University	.073	14
Higher University	.536**	23
Graduate School	.328	24

Log. Correlation

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Elementary School	-.390	24
Advanced Primary School	.207	24
Lower Medium School	.581**	24
Higher Medium School	.679**	24
Lower University	-.083	11
Higher University	.569**	22
Graduate School	.548**	24

** Significant at .01 Level
* Significant at .05 Level

Country: Norway 1960

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Other	.007	27
Lower Vocational	.015	27
Higher Vocational	-.071	27
University	.269	27

Log. Correlation

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Other	.040	27
Lower Vocational	.041	27
Higher Vocational	.030	27
University	.511**	27

** Significant at .01 Level
* Significant at .05 Level

Country: Yugoslavia 1961

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Without Schooling	-.057	20
4-7	.056	20
Elementary	.093	20
Lower Vocational	.097	20
High School and Higher Vocational	.473*	20
Sub-University	.003	20
University	-.148	20

Log. Correlation

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Without Schooling	-.133	20
4-7	.059	20
Elementary	.185	20
Lower Vocational	.242	20
High School and Higher Vocational	.474*	20
Sub-University	.188	20
University	-.055	20

** Significant at .01 Level
* Significant at .05 Level

Country: France 1962

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Primary	-.151	21
B.E.P.C.	.264	21
Secondary	.368	21
University	.726**	21

Log. Correlation

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Primary	-.185	21
B.E.P.C.	.492*	21
Secondary	.513*	21
University	.730**	21

** Significant at .01 Level
* Significant at .05 Level

Country: Argentina 1960

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Without Schooling	-.104	24
1-6	-.395	24
7-11	.324	24
12	.267	24
13-15	.407*	24
16+	.259	24

Log. Correlation

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Without Schooling	-.176	24
1-6	-.266	24
7-11	.305	24
12	.309	24
13-15	.468*	23
16+	.436*	23

** Significant at .01 Level
* Significant at .05 Level

Country: West Germany 1960

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Higher	.633**	18
Vocational	.539	18
Apprenticeship	-.195	18
Without Formal Training	.096	18

Log. Correlation

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
Higher	.650**	18
Vocational	.454	18
Apprenticeship	-.179	18
Without Formal Training	.043	18

** Significant at .01 Level
* Significant at .05 Level

Country: Japan 1960

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
No Schooling	-.365	23
Elementary	-.472	23
Junior High	-.280	23
Senior High	.568**	23
Junior College	.127	23
University	.487**	23

Log. Correlation

Variable Description (x) Highest Level of Education Completed	Correlation Coefficient	Number of Observations
No Schooling	-.569**	23
Elementary	-.655**	23
Junior High	-.161	23
Senior High	.598**	23
Junior College	.485*	23
University	.523**	23

** Significant at .01 Level
* Significant at .05 Level

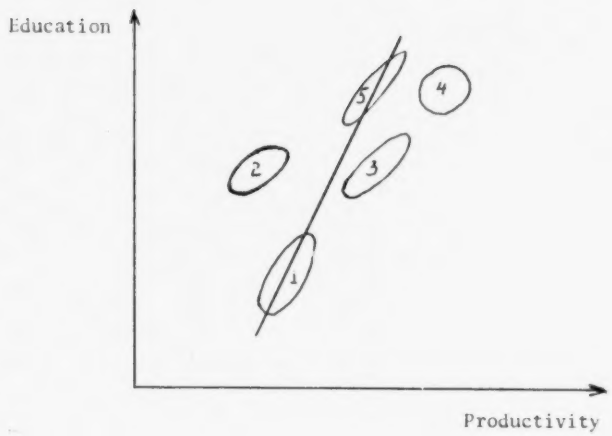

FIGURE I

Figure I illustrates what may be happening. If there is a fairly good relationship between education and productivity at the two extremes of the data as with micro-observations (1) and (5) even though correlations of subgroups may be weak or non-existent, the correlation coefficient of the aggregate may be substantial. This seems to be the case in our analysis.

If we disregard the country, however, and correlate productivity of the same industry across countries with the educational levels we find that the correlations in these cases are much higher than when correlating all industries together, or correlating industries in the same country. (See table III).

It is also interesting to note that when correlating an aggregate across countries, such as manufacturing, we do not obtain a higher correlation than when we correlate some of

the components of this aggregate such as a 2 digit industry. (See table III).

The correlation of productivity of the industry across countries with the educational level of the same industry is only meaningful at the levels of 12+, 13+ and 16+ years. It is also interesting to note that only in the sectors of Utilities and Finance do the groups of 0-4 and 0-8 have any significance.

There are some industries where there is no meaningful relationship between the variables. These are: Tobacco and Tobacco Products, Clothing, Leather and Leather Products, Wood and Wood Products, Petroleum and Coal Products.

In appraising tables I, II, and III we may conclude that there is a relationship between productivity and education. This relationship is extremely weak when we correlate productivity and education of different industries in the same country, stronger when we correlate productivity of all industries and sectors and education across countries, and strongest when correlating productivity and education of the same industry across countries. All these correlations are most significant at the post-secondary level of education and almost nonexistent at the primary level.

The role of educational levels of occupations in determining the educational distribution of industries

Because the educational distribution of an industry is the product of an occupational vector and an educational matrix of education by occupation, the existence of a relationship between productivity and the distribution of the education in a given industry can be the result of a higher occupational mix, such as more engineers and fewer operators or a higher level of education for the same occupations.

TABLE III

Linear and Logarithmic Correlations of Productivity and Education of Industries

$$y_i = a + b x_i$$

Variable Description (x) Years of Education	INDUSTRY											
	Agriculture, Forestry and Fishing			Mining and Quarrying			Construction			Manufacturing			Food and Beverages			Tobacco and Tobacco Prods.		
	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}
0-4	7	-.131	.133	7	-.186	.152	7	-.002	.219	7	-.101	.111	7	-.008	.192	7	-.063	.396
less than 8	10	.027	.107	10	-.157	.040	10	-.240	.023	10	-.167	.181	11	-.383	-.092	11	-.252	.187
12	7	.371	.119	7	.445	.221	7	.611	.379	7	.706	.558	7	.633	.437	7	.396	.182
12+	8	.336	-.088	8	.515	.105	8	.637	.198	8	.766*	.541	8	.661	.320	8	.384	.162
13+	8	.617	.235	9	.629	.363	9	.663	.231	9	.817**	.472	9	.714*	.282	9	.147	.092
16+	9	.171	.191	9	.754*	.541	9	.685*	.339	9	.831**	.660	10	.602	.285	10	.064	.036

N = Number of Observations
r_{lin} = Coefficient of Linear Correlations
r_{log} = Coefficient of Logarithmic Correlations
** = Significant at .01 Level
* = Significant at .05 Level

Linear and Logarithmic Correlations of Productivity and Education of Industries

$$y_i = a + b\,x_i$$

Variable Description (x) Years of Education	INDUSTRY																			
	Textile Mill Products			Clothing and Other Fabric Textiles			Leather and Its Prod. (exc. Ftwr)			Lumb. and Wood Prod. (inc. Furn)			Paper and Paper Products			Printing and Publishing		
	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}
0-4	7	.328	.354	6	.662	.454	7	.301	.304	7	-.119	.133	7	.189	.373	7	-.230	.079
less than 8	11	.178	.108	10	.094	.477	11	-.228	.046	11	-.307	-.042	11	-.269	.047	11	-.541	-.240
12	7	.724	.463	6	.592	.462	7	.670	.434	7	.734	.554	7	.619	.351	7	.637	.515
12+	8	.743*	.389	7	.657	.367	7	.656	.354	8	.765	.480	8	.689	.395	8	.700	.453
13+	9	.770*	.384	8	.705	.427	8	.673	.469	9	.692	.414	9	.741*	.382	9	.827**	.580
16+	10	.640*	.395	9	.638	.298	8	.272	.277	10	.655	.425	10	.597	.345	10	.705*	.480

N = Number
r_{lin} = Coefficient of Linear Correlations
r_{log} = Coefficient of Logarithmic Correlations
** = Significant at .01 Level
* = Significant at .05 Level

Linear and Logarithmic Correlations of Productivity and Education of Industries

$$y_1 = a + b\,x_1$$

Variable Description (x) Years of Education	INDUSTRY											
	Rubber Products			Chemicals and Chemical Products			Petroleum and Coal Products			Glass, Stone and Clay Products			Primary Metals			Fabr. Metal Prod. (exc. Mach)		
	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}
0-4	7	-.318	-.038	7	-.197	.035	7	-.207	-.024	6	- 386	-.120	6	.212	.181	6	.032	.241
less than 8	10	-.397	-.013	11	-.476	-.230	11	.432	-.280	10	-.453	-.131	10	-.298	.020	10	.392	-.059
12	6	.702	.568	7	.573	.567	7	.422	.491	6	.615	.430	7	.650	.409	7	.688	.448
12+	7	.747	.567	8	.821*	.687	8	.417	.186	7	.730	.591	8	.708*	.505	8	.797*	.522
13+	9	.765*	.382	9	.857**	.757*	9	.270	-.070	8	.896**	.711*	8	.745*	.481	8	.872**	.543
16+	9	.760*	.432	10	.868**	.735	10	.177	-.038	9	.864**	.744*	10	.672*	.615	10	.847**	.641*

N = Number of Observations
r_{lin} = Coefficient of Linear Correlations
r_{log} = Coefficient of Logarithmic Correlations
** = Significant at .01 Level
* = Significant at .05 Level

Linear and Logarithmic Correlations of Productivity and Education of Industries

$$y_i = a + b\,x_i$$

Variable Description (x) Years of Education	INDUSTRY																					
	Machinery (exc. Electrical)			Electrical Mach. and Equip.			Transportation Equipment			Profess. and Scientific Equipment			Utilities			Trade		
	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}
0-4	6	.079	.252	6	-.554	-.413	6	.320	.213	3	.211	.127	5	-.241	.018	5	.027	.283
less than 8	10	.375	-.071	11	-.383	-.073	9	-.431	-.135	7	-.344	-.016	8	-.777*	-.637	8	-.233	.114
12	7	.718	.465	7	.571	.471	5	.699	.822	4	.590	.768	5	.805*	.616	5	.303	.218
12+	8	.775*	.521	8	.652	.	6	.791	.671	4	.795	.860	6	.790*	.520	6	.427	.075
13+	8	.716*	.381	9	.702*	.	8	.840**	.514	4	.995**	.930	7	.673	.295	7	.712	.256
16+	10	.689*	.536	10	.859**	/*	8	.857**	.643	5	.927*	.839	7	.672	.335	7	.507	.144

N = Number of Observations
r_{lin} = Coefficient of Linear Correlations
r_{log} = Coefficient of Logarithmic Correlations
** = Significant at .01 Level
* = Significant at .05 Level

Linear and Logarithmic Correlations of Productivity and Education of Industries

$$y_i = a + b\,x_i$$

Variable Description (x) Years of Education	INDUSTRY					
	Finance, Insurance and Real Estate			Services		
	N	r_{lin}	r_{log}	N	r_{lin}	r_{log}
0-4	4	-.951*	-.887	7	-.186	.141
less than 8	7	-.760*	-.711	9	-.337	-.032
12	4	-.991**	.910	6	.584	.392
12+	5	.948*	.698	7	.602	.615
13+	6	.740	.312	9	.375	.368
16+	6	.658	.420	8	.686	.597

N = Number of Observations
r_{lin} = Coefficient of Linear Correlations
r_{log} = Coefficient of Logarithmic Correlations
** = Significant at .01 Level
* = Significant at .05 Level

For example, we may have the same proportion of typists, but typists in one case have more education than in another or in a combination of both.

A comparison of the educational levels of specific occupations in different countries may help provide the first clue to the question: Is the educational level of each occupation a major factor in determining the educational distribution of the labor force in an industry, or does it only lend a subsidiary effect to the occupational distribution effect?

International Comparison of Educational Levels of Occupation

The literature on the educational level of occupations is quite sparse. The study of the relationship of occupations to their level of education is a recent phenomenon. The few existing works deal mainly with the analysis of educational attainments of occupations in a given country.[36] In the U.S. Eckaus,[37] surveying the educational requirements of occupations in the Estimates of Worker Traits Requirements for 4,000 jobs,[38] found that actual educational

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36. See for example J. R. Dale The Clerk in Industry: A Survey of the Educational Experience Status Education and Vocational Training of a Group of Male Clerks Employed by Industrial Companies. Liverpool University Press, 1962. C. Beyazov, Technological Change and Manpower in a Centrally Planned Economy, ILO Human Resource Department, Geneva 1966.

37. R. S. Eckaus "Economic Criteria for Education and Training" Review of Economics and Statistics, May 1964.

38. Department of Labor Bureau of Employment Security U.S. Employment Service, 1956.

attainments by industry as expressed in the Census exceeded the educational requirements of the jobs. Horowitz and Herrnstadt[39] found that there was little change in the educational requirements as expressed in the Dictionary of Occupational Titles of 1949 and 1966, and that many of the new jobs of the DOT in 1966 not in existence in 1949 had even lower educational requirements than comparable jobs in 1949. J. R. Blight [40] in a study of 13 plants also found that automation did not upgrade the skill requirements of the labor force. Another study by Scoville[41] shows a small increase over time in the educational requirements of occupations between 1940 and 1960, but that the vast majority of jobs had a median schooling higher than the schooling requirements of the job.

An analysis by John K. Folger and Charles B. Nam[42] is one of the first ones to focus the problem on the interaction of structure of the labor force and educational

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39. "Changes in the Skill Requirements of Occupation in Selected Industries" in The Employment Impact of Technological Change, Vol. II Technology and the American Economy: The Report of the Commission Studies prepared for the National Commission on Technology, Automation, and Economic Progress, Feb. 1966, U.S. Government Printing Office.

40. "Does Automation Raise Skill Requirements?" Harvard Business Review, July-August 1958.

41. "Education and Training Requirements for Occupations", Review of Economics and Statistics, Nov. 1966.

42. John K. Folger and Charles B. Nam op. cit.

attainment within occupations: their analysis shows "that the improvement in educational attainment within occupations is a much more important factor in the rise of the educational level of workers than the change in the occupational structure of the labor force" and that "the relationship between education and occupation is getting weaker. For example, the measure of association declined from 1940 to 1960 from +.52 to +.39. (Using gamma as a measure of association)".

International comparisons of educational attainments of occupations do not exist. Some existing works deal only with the international comparison of educational requirements of occupations[43].

The only source of information available covering a wide spectrum of occupations and educational attainments in different countries are different Censuses. The analysis that follows is confined to a sample of Clerical, Sales, and Manual Workers. The group of "Professional and Technical Workers" was left out because levels of schooling for these occupations are fairly standardized for most countries. Also, the group of managers was left out because the data is too aggregated and the classification criteria in most Censuses is based on a Socio-Economic Classification rather than on complexity of tasks. For example, most countries lump together owners of small businesses and farmers with self-employed managers of industrial establishments.

Only those occupations with a 3 or 5 digit classification are presented to avoid the overshadowing effect of the

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43. See for example European Apprenticeship Effects of Educational, Social and Technical Development on Apprentice Training Practices in eight Countries. ILO Human Resource Department. Geneva 1966.

occupational structure within a classification. Appendix 2 presents the distribution of education by occupation for 10 countries, four of which have data for two periods.

The years of schooling were standardized as explained on page 15. The title of the occupations and the corresponding International Standard Classification of Occupations' number and explanations are given in Appendix 3.

Intertemporal Comparisons

There is data available for two points in time for four countries. This allows us to see what happened to the level of education of an occupation when there was an increase in income per capita for the same country. This intertemporal analysis avoids the pitfalls of international comparisons of levels of education and of occupations.

Comparison of Educational Levels of Occupations in the U.S. Between 1950 and 1960

For most Clerical workers the educational attainment did not shift noticeably. (The median of bookkeepers shows even a slight decline of .6% between 1950 and 1960. On the other hand, there was a marked increase in the level of education of Foremen and Supervisors. For this last group, in 1960, the proportion of those with a High School Degree increased by 7% and those with some university training by 4%.

The same large increase can be noticed among Sales Representatives, Brokers and Salesmen. The increase is noticeable in all categories from Junior High School to University levels.

Among Farm Workers and Farmers there was an upward shift out from the primary school level to the 9-11 years of schooling category. However, the proportions of those with

High School and Higher Levels of Education did not change markedly.

The educational level of Miners also shows a marked shift upwards, starting with Junior High School.

In all other Manual Occupations (except Pressmen and Printers) there is an upward shift of the level of education between 1950 and 1960. The shift is across the board, namely: the percentage of people in all educational categories from Junior High School onward increased in 1960 compared with the percentage of people in the same educational categories in 1950. (The shift is out of the level of 0-8 years of schooling). In the case of Pressmen and Printers, the proportion of high school graduates remained the same and the percent of those with higher education dropped from 1950 to 1960. In view of the trend observed in all other occupations it seems that technological progress in the Printing Industry does not require higher educational levels, and that automation may, in fact, have lowered the educational requirements in this industry (For other possible reasons see the note on the Distribution of Education in Occupations. Pages 64-70).

Two other cases are worth mentioning because of their implications. These are Unskilled Laborers and Domestic Servants and Cleaners. The educational levels of these groups rose 5.1% and 5% respectively (if the shift is measured by the shift of the median educational level). Even more interesting is the fact that from 1950 to 1960 the proportion of those with some High School Education or higher rose from 31.6% to 43.3% in the unskilled labor category, and from 33.2% to 43.5% in the Domestic Cleaners and Servants category. (For a more detailed analysis and hypothesis see pages 53-54).

Comparison of Educational Level of Occupations in Canada 1951-1961

Among Clerical workers the shift during this period is from the 9-12 category to the 13+ category. In the case of Postmen there was also an upward shift in the 9-12 category out of the 5-8 category. The same shift from 9-12 to 13+ can be seen also among Sales Workers. The strongest rise, however, can be found among Foremen and Supervisors, where the proportion of those in the categories 9-12 and 13+ rose from 45.2% to 48% and from 6.4% to 10.9% respectively. Interestingly, the educational level of farmers did not change very much, and unless there was some intergroup shift, the educational level of Farmers in 1961 is a tiny bit lower than in 1951. The level of Miners, on the other hand, is markedly higher. For most other occupations the pattern is the same as in the U.S., i.e., a shift to a higher educational level. An exception is Bricklayers and Masons. The average level went down between 1950 and 1960. Another exception occurs with unskilled laborers, where there was a sharp drop in educational levels between 1951 and 1961. On the other hand there was a sharp increase in the educational levels of Domestic Servants and Cleaners during the same period.

Comparison of Educational Attainment of Workers in United Kingdom 1951-1961

Clerical Workers show a shift upwards in all categories. The same occurs with Sales Workers.

Farmers show a remarkable shift upwards, especially in the category equivalent to the 9-10 years of Schooling (from 10.2% to 27.1%). The same shift is noticed in the

category of Miners, (the proportion of Miners with 9-10 years of schooling rose from 4.2% to 19.8%).

The rise in educational attainments is also general for most other occupations, except, as in the U.S., in this case of Pressmen and Printers where the percentage of people with higher education is lower in 1961 than in 1951.

The levels of education of unskilled workers and Domestic Servants are also higher in 1961 than in 1951.

Comparison of Educational Attainment of Workers in Japan 1950 and 1960

The educational pattern of clerical workers shows a marked upward movement between 1950 and 1960. This is reflected mainly in the growth of the proportion of people that have at least 12 years of education, and an upward shift of the proportion of people with Senior High School, as compared with those who only had Junior High School Education. However, the educational level of secretaries and stenographers and typists did not change very much.

There was also a similar upward movement among Sales Workers, Sales Representatives and Brokers, Salesmen and Assistants.

Among Farmers, the big shift is out of the illiteracy and Elementary Schooling, into Junior and High School levels. Again here, the two groups reflecting no demand for special skills. Unskilled laborers and Domestic Servants dramatize the general rise in educational levels. These two groups had in 1950 14.9% and 20% of people with less than 4 years of schooling and 22.5% and 30.7% respectively of elementary school graduates. In 1960 there were only 1.2% illiterates and 20.8% and 16.7% elementary school graduates respectively.

International Comparisons

We have seen in comparing the educational attainments of people in an occupation in a given country in two periods of time that an increase in income is associated with a rise in the average formal level of education for the vast majority of occupations. Does this conclusion stand when we compare the educational levels of an occupation across national boundaries?

We shall consider the Clerical, Sales, and Manual Workers separately.

Clerical Workers

The educational level of Clerical Workers is linked mostly with post primary and lower university levels of education. If we take the proportion of people with 12 years or more education among Bookkeepers we find that Japan 1960 has the highest proportion, followed by the U.S. 1960 and 1950, Yugoslavia, Argentina, Netherlands and West Germany.

On the other hand if we take 8 years or less of schooling as another indicator we find that the U.S. in 1960 has the lowest proportion followed by Canada, Japan, Yugoslavia and finally Argentina.

We can see that if we rank[44] Income per Capita and any

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44. Ranking is done as follows: for the criteria using 0-8 years of schooling those with the lowest proportion in this category rank highest. For the 12+ years of schooling those with highest percent in this category rank highest. We should expect a direct correlation between Income per Capita and 12+ years of schooling and an inverse correlation between Income per Capita and 8 or less years of schooling.

of the two levels of schooling there is no direct correspondence. The same lack of pattern between Income per Capita and years of formal schooling can be seen when analyzing the group of Secretaries and Typists. Eight-six percent of this group in the U.S. in 1960 and 83.6% in Japan 1960 have at least a High School Education, while the same occupational group in countries like Netherlands in 1960, West Germany in 1957 and the United Kingdom in 1961 have 10.9%, 38.2% and 50.5% respectively in the same educational category.

A correspondence seems to exist only in the case of Postmen: the proportion of Postmen with 8 years or less of education in the U.S. in 1960 is 12%, 38% in Canada in 1961, 73.3% in United Kingdom in 1961, 71.5% in Japan in 1960, 83.10% in Argentina in 1960 and 91.8% in Yugoslavia in 1961. The case is weaker when considering the category of 12 or more years of schooling.

Sales Workers

In these occupations Japan 1960 and the United Kingdom 1961 rank higher than West Germany 1957 and France 1962 in the category of 12 or more years of education, while United Kingdom 1961 ranks higher than France 1962 and Holland 1960 with a lower proportion of people with 8 or less years of education.

Manual Workers

In the case of Foremen and Supervisors, in the countries where these classifications exist, the proportion of those with 8 or less years of schooling is highest in the United Kingdom 1951, and lowest in the U.S. 1960. Yugoslavia, which ranks quite low in the educational level of clerical

workers, ranks above Japan 1950 and almost as high as Canada 1951 in this category. Also Norway, that ranked in the lower part of the scale for clerical workers, has quite a high proportion of Foremen and Supervisors with 11 or more years of schooling.

The distribution of education of Farmers also presents a different picture. Holland has a very high percent of Farmers with 9 years of schooling (50.4%) only topped by the U.S. 1960 and Japan 1960. The proportion of people with 8 years or less of schooling goes from a high in Argentina of 98.7% to a low for Japan 1960 of 27%. According to the 0-8 years of schooling category, United Kingdom and Holland would rank before West Germany and France. On the other hand, if we take the criteria of 9 years or more of schooling we have Japan 1960 in first place followed by Holland and the U.S., Canada, United Kingdom, Norway, West Germany, France and Argentina.

The data on educational levels of Miners also shows that in the criteria of 0-8 years of schooling Argentina and Yugoslavia rank the lowest, while the highest is for Japan 1960 and U.S. 1950 and 1960, followed by Canada 1961. If we take the 12+ years of schooling as criteria, the U.S. precedes Japan, and West Germany, the rest of the European Countries. A sample of blue collar occupations failed to reveal any pattern for the distribution of education among occupations in high and low income per capita countries, although the United States ranks consistently highest and Argentina and Yugoslavia rank consistently lowest, regardless of what yardstick we use for the ranking. The ranking of countries like Norway, Holland, United Kingdom, Germany and Canada is erratic and depends on the particular occupation. In the occupation "Bakers" for example, Holland

ranks highest in the 0-8 category but low in the 12+ category. On the other hand, in the occupation "Sawyer" Holland ranks below the United Kingdom and Canada according to the 0-8 years category. West Germany, which ranks higher than the United Kingdom in the 12+ years group for "Bakers", ranks lower than the United Kingdom in the same category for "Tool and Die Makers".

The European countries, in general, tend to rank low in the 12+ category (except in such highly skilled occupations as Tool and Die Makers and Electricians, and tend to rank in a random pattern in the 0-8 category. The bulk of people, however, are in the 9-11 years category.

Some Conclusions

In analyzing the educational level of different occupations across countries we find that there is no direct relationship between the different levels of education of each occupation and Income per Capita.

Much has been written about the dual character of education, that of consumption and that of investment. A knowledge of the behavior of these variables would be a giant step in predicting future demand for educational services. But it is impossible to separate completely the educational consumption from the investment aspect of education. A definite test does not exist. Nevertheless some light may be shed on the question: Is consumption of education strictly a function of some measure of income or also of other variables such as tradition, social customs, and so on?

A possible test to see if it is possible to isolate a "pure consumption form" of education would be to see what

the level of education is of different cohorts of people who do not enter the labor force during their lifetime, and compare it with some measure of income over time. This data is not available and would be very hard to come by. A weak proxy for this type of data, insufficient for providing a definite answer to the question, would be to relate income per capita to the educational attainments of people in occupations that do not require more than a bare minimum of education, or no education at all, to perform successfully in their jobs. The occupations of Domestic Servants and Cleaners, and Unskilled Laborers, seem to fulfill this requisite.

We have seen on page 46 that for the countries for which we have data for two periods, the educational level of Unskilled Workers and Domestic Servants rose when income per capita rose (except in the case of Unskilled Workers in Canada between 1951 and 1961).

However, when we analyze the relationship across countries we find that there is no meaningful correlation between income per capita and the level of education of Unskilled Workers and Domestic Servants. (See table IV).

Assuming that the educational level of these two groups reflects in some degree the consumption of education, (because no special skills and education are needed) we may conclude that consumption of education is only a function of income per capita if all other relevant (and unknown) variables are held constant. Such would be the case when analyzing what happens with education of a given occupation in the same country over time. If all other variables are not held constant, as when comparing an occupation across countries, the relationship between consumption of education and income per capita does not hold. This conclusion

TABLE IV

Linear and Logarithmic Correlations of Income per Capita
Education of Domestic Servants and Cleaners

$$y = a + b\, x_i$$

$$\text{Log } y = a + b \log x_i$$

y = income per capita

x_i = proportion of with i level of education

Variable Description (x_i) Years of Education	Correlation Coefficient (Linear)	Correlation Coefficient (Logarithmic)	Number of Observations
0-4	-.445	-.233	7
0-8	-.341	-.184	12
9-12	.181	.196	14
12	.331	.252	8
12+	.459	.241	9
13+	.519	.515	10
Median of Distribution	.440	.390	11

** Significant at .01 Level
* Significant at .05 Level

TABLE IV (Continued)

Linear and Logarithmic Correlations of Income per Capita and Education of Laborers

$$y = a + b\, x_i$$

$$\text{Log } y = a + b \log x_i$$

y = income per capita

x_i = proportion of with i level of education

Variable Description (x_i) Years of Education	Correlation Coefficient (Linear)	Correlation Coefficient (Logarithmic)	Number of Observations
0-4	.112	.144	14
0-8	-.216	-.115	7
9-12	.089	.180	12
12	.439	.113	14
12+	.525	.218	9
13+	.660*	.401	10
Median of Distribution	.231	.241	10

** Significant at .01 Level
* Significant at .05 Level

is, of course, tentative. Domestic Servants and Unskilled Laborers are a poor proxy for the population as a whole; they may reflect the consumption pattern of a given social class, and their educational distribution of education may be a reflection only of job opportunity.

The data presented here, however, suggests that formal levels of education of an occupation are mostly tied in with social and legal customs. Take for example Japan: The higher proportion of people with 9 years of education in 1960 compared with 1950 is due to reforms in the educational system introduced after the Second World War, that transformed the 6-2-3 system, followed by most people in the blue collar occupations, into the 6-3-3 system existent today.[45]

In countries where the compulsory system ends in the 6th and 7th grade, as in Argentina and Yugoslavia and in countries where formal vocational schools are not looked upon with favor, the education of most workers tends to concentrate around the 6-7 year mark, unless some skills cannot be acquired soley with "On the Job Training". This is the case, for example, of electricians, where we find a sizeable number of workers in Argentina and Yugoslavia who have more years of education than required by compulsory education.

In countries like Holland and Norway, where the vocational system is highly developed, we find a large proportion of workers with some years of formal education after the minimum legal requirements.

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45. See Ronald S. Anderson, Japan Three Epochs of Modern Education; U.S. Dept. of Health Education and Welfare, Bulletin No. 11, 1959.

In countries like the U.S. and Canada where the level of compulsory education is high, we may expect workers even in menial tasks to have high levels of formal training. For example, the proportion of those with 8 years or less of education in Argentina, and the proportion of those with 12 years and more among Unskilled Laborers in the U.S. is higher than the proportion of Electricians in Yugoslavia who have more than 12 years of education.

Looking at the data, one is impressed by the diversity of paths through which skills can be acquired. In a technologically advanced country such as West Germany we find that in most manual occupations from 30% to 70% of the work force had no formal training. The proportion of people with formal vocational schooling is seldom over 20%. The vast majority of the skilled workers go through an apprenticeship program after finishing the minimum legal requirement of formal education.

Clearly, the idea that more years of formal education by occupation is tantamount to higher productivity is misleading. There is a trade-off between formal education, apprenticeship programs, on the job training, experience and other plausible forms of acquiring the necessary skills for performing a function successfully in an industrial society. The amount of trade-offs has to be appraised in terms of local conditions and social settings, but the most important lesson is that there are available alternatives from which to choose.

Occupational Structure or Educational Levels of Occupations. A Statistical Test.[46]

We have seen that the educational distribution of the labor force in a given industry can be expressed as the product of the occupational distribution of the labor force and the educational distribution of the occupations.

$$\eta_{ci} = \sum_j \left(\frac{l_{cije}}{l_{cij+}}\right) \left(\frac{l_{cij+}}{l_{ci++}}\right) = \sum_j \eta_{cij} \lambda_{cij}$$

where η_{ci} is the proportion of laborers with education level c in industry i in country c

l_{cije} = labor with occupation j in industry i in country c with education e

λ_{cij} = occupational distribution of the labor force in country c in industry i

η_{cif} = educational distribution of an occupation

We have also defined $\pi_{ci} = \frac{Pci}{lci++}$ productivity of industry i in country c. We have also seen that there exists a relationship between π_{ci} and η_{ci}, but this may be due to η_{cij} or λ_{cij} or both.

To determine the relative importance of η_{cij} and λ_{cij} we write:

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46. I wish to thank Professor Paul Holland of the Statistics Department of Harvard University for his helpful suggestions.

$$\hat{\eta}_{ci} = \sum_j \eta_{cij} \bar{\lambda}_{cij}$$

$$\hat{\hat{\eta}}_{ci} = \sum_j \bar{\eta}_{cij} \lambda_{cij}$$

where $\hat{\eta}_{ci}$ is the "standardized" education fixing the occupational distribution, and $\hat{\hat{\eta}}_{ci}$ is the "standardized" education fixing the educational distribution of occupations.

If correlations $\rho(\pi_{ci}, \hat{\eta}_{ci})$ and correlations $\rho(\pi_{ci}, \hat{\hat{\eta}}_{ci})$ are similar, then no clear answer is available. However, if they are completely different, in conjunction with $\rho(\pi_{ci}, \eta_{ci})$ some conclusions may be inferred from the data. In our case the test was performed using data for manufacturing as a whole because of the large amount of computations involved, and because, in general, the behavior of the variables in the manufacturing sector as a whole reflected the behavior of the same variables of 2 digit industries in all other experiments.

The occupational classification of these sectors consists of more than 200 occupations, and the educational distribution of occupations consists of 5 levels. The standard occupational distribution was obtained by averaging the occupational distribution of Manufacturing over 14 observations. The results can be seen in Table V. For the correlation of productivity with "standardized" educational distributions we took as proxy the correlation of productivity with pure occupational distributions, since it has been proven already that a strong correlation exists between productivity and occupational distribution of an industry (See M. Zymelman, Productivity, Skills and Education in

TABLE V

Linear and Logarithmic Correlations Between Productivity and Educational Distribution of the Labor Force in Manufacturing with a "Standardized" Occupational Distribution

$$y = a + b\,x_i$$

Variable Description (x_i) Years of Education	Correlation Coefficient (Linear)	Correlation Coefficient (Logarithmic)	Number of Observations
0-4	.284	.265	6
0-8	-.290	-.018	10
12	.624	.513	8
12+	.684	.532	6
13+	.603	.268	10
16+	.205	.166	9

** Significant at .01 Level
* Significant at .05 Level

Manufacturing Industries, UNIDO ID/WC.3/DP), and no different results will appear if we multiply the occupational structures by a "standardized" educational distribution of occupations.

In summary, our experiment shows the following results:

$\rho(\pi_{ci}, \eta_{ci})$ high and statistically significant

$\rho(\pi_{ci}, \hat{\eta})$ high and statistically significant

$\rho(\pi_{ci}, \hat{\eta})$ low and statistically insignificant

We can, therefore, infer that the occupational structure is the significant factor in determining the correlation between productivity and the educational distribution of the labor force in an industry.

The Meaning of the Educational Distribution of Occupations and their Usefulness for Planning

Many of the Educational Planning Models[47] derive the demand for different levels of education from the occupational distribution and the years of education of each occupation. The years of education for the different occupations are presumably derived from available educational distributions of occupations and "educated" guesses of experts. Sometimes the educational distributions of occupations of one country are used to program education in other countries. This is done without the realization that the distribution of education in a given occupation is a statistical abstraction that summarizes the education history of the group under consideration, and that this history goes back, at least, to the days of the oldest member of the group under study.

47. See for example Herbert Parnes op. cit. and Econometric Models of Education, Some Applications, OECD, Paris, 1965.

The educational distribution of an occupation changes over time and its parameters vary continuously. Why and how does this change occur?

We start with a group of people in an occupation distributed by age and different levels of education at time t. During the next period we will have:

$$L_{ijt+1} = L_{ijt} + L_{ijt} + O_{ijt}$$

where L_{ijt} is laborers with age i and education j at time t

I_{ijt} is inflow of laborers during time t with age i and education j

O_{ijt} is outflow of laborers during time t with age and education j

Most of the inflow consists of new entrants to the labor force in that particular occupation, e.g., foreign immigrants with this occupation joining the labor force, rural immigrants who enter this occupation, and people shifting into this occupation from other similar occupations.

The outflow consists of attrition of existing labor because of health, death, and retirement emigration, and people shifting from this occupation to others.

We have on purpose made a detailed account of the type of people who join or drop out of an occupation, because each one possesses, in general, different characteristics and thereby influences differently the distribution of education in a particular occupation. For example: the group of new entrants to the labor force consists largely of young people who have generally higher formal education than the older workers in the occupation, since compulsory education is becoming higher over time.

The group of foreign immigrants exerts an important influence in countries where foreign immigration contributes in a large measure to the labor force, as in the cases of Israel, Australia and Canada. The amount of education that they contribute varies in each particular case, and historically they shaped the distribution of education in occupation in countries like the U.S., Argentina, Australia and so on.

The group of rural immigrants joining the labor force of the cities is extremely important in the developing countries. Emigration from the rural areas has the tendency of lowering both the level of education of the remaining rural group and that of the urban group which they join. This is because most of the migrants are young, and a large percent of them are with better schooling then the people who remain who are older, with a larger percent of women. When this group arrives in the city, they tend to have less schooling than the city dwellers, thus lowering the cities' average level of education.[48]

The group of people shifting in and out from one occupation to similar ones has only a marginal influence on the educational distribution, but they provide a stabilizing effect on the distribution of education over time. (See below).

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48. This conclusion may seem a paradox, because it may mean that by offering more education in the rural areas, and by providing an educational incentive to leave the village, the educational averages of both the rural and urban areas go down. This is, however, a statistical mirage, because the national average does go up. This statistical paradox is possible when the disparity between educational levels of city and rural areas is large.

Most of the outflow of people from an occupation is due to natural causes such as death and sickness. The number of people dropping out for these reasons is directly related to the age distribution of the group. The other major cause for a continuous outflow is retirement, which is dependent partially on the age distribution and partially on the variation of the retirement laws over time. These law-changes, because they come at discrete intervals, tend to affect the outflow of people between the discrete intervals at which the laws are applied.

To analyze the forces that shape the educational distribution, and for the sake of simplicity, we shall assume that we have, as the inflow to the occupation only people joining the labor force for the first time, and as the outflow, people retiring because of death and retirement age. We shall assume also that we have a number of people changing jobs. This last group can be a net inflow or a net outflow.

Assuming that every worker is qualified to perform the task required by the occupation, it is plausible that an employer will prefer the individual who has a higher formal education, ceteribus paribus. However, the amount of education embodied in a worker whom the employers will be able to hire, will depend on labor market conditions.

If we assume "normalcy"[49] in the labor market, and also

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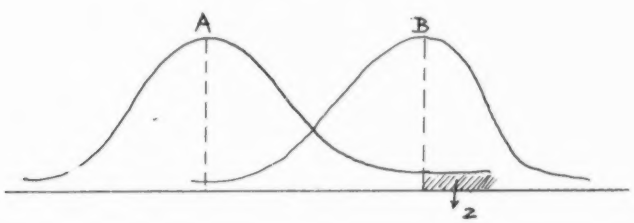
49. "Normalcy" in this context means that employers expect that incoming workers have at least the median education level of the existing group, and that there is a supply of new people with this occupation and educational level sufficient to satisfy the market demand for this occupation.

introduce the plausible assumption that younger members of the group usually have more formal education than older members, because of the general tendency to increase the years of compulsory education, we can conclude that there is a built-in upward bias over time to shift the median years of education in a given occupation, because, at any moment of time, the inflow of people has at least the median educational level, while the outflow has a lower educational level than the median.

There is, however, a dampening effect on this upward bias. An important factor in determining the supply of people with a given type of occupation and education is the relative wage being paid for this occupation vis a vis other occupations, that, though similar, demand more education.

If the actual distribution of education of two occupations A and B are as follows:



and we assume that employers of B would accept in "normal times" people with the median of education of B, all those in group Z will be able to retrain for occupation B. If the wage differential between occupation A and B is large enough, people with the higher level of education working in occupation A will try to switch to occupation B by retraining, thus lowering the median level of occupation A.

If, however, we assume that relative wages do not change, and relax the assumption of "normalcy", the amount of education that the new entrants will bring to the group will vary with market conditions for the occupation. In times of labor shortages employers will accept people with less formal education, less even than the existing median of the distribution, and the new median may therefore go down. On the other hand, when there is a surplus of labor in a given occupation, the employers can be choosier and may demand higher education. In this latter case, the median level of education of the group may go up. The shift in each case of the median will depend on weight of the years of education of the incoming and outgoing members of the group.

We can see, therefore, that the existing distribution of education in a given occupation is the outcome of the cumulative influence of the number, age and education of the people who joined the labor force in this occupation in every period of time in the past. These in turn depend on labor market conditions, including relative wages in this occupation vis a vis similar occupations.

The analysis presented above leads us to conclude that to apply the distribution of education of a given occupation of one country to determine future educational requirements of another, is to apply a "petrified chronicle of the past", a summarized history of institutional and market conditions of the model country; a history that the developing country may not be eager to repeat.

On the other hand, this type of analysis applied to the existing distribution in an occupation by age and education of the same country may yield good results for determining future educational requirements of an

occupation that change over time. This can be done by knowing the educational and age distribution of the workers in an occupation in the initial period, and forecasting future development of labor markets for this and similar occupations, the ebbs and flows of employment, migration, and not least, legal imposed changes such as compulsory education, minimum age for joining the labor force, and retirement age.

Summary and Conclusions

Most available research in the area of education and economic development points to a direct relationship between higher productivity, or income per capita, and higher formal education. These relationships are usually used as a preamble for policies that should be based on an unequivocal casual relationship between education and development. The analysis presented in this paper by approaching the problem from a more microscopic point of view tries to affix importance to the different factors involved.

Instead of correlating income per capita or other global measures with education, we tested the existence of a relationship between value added per worker in industries and the respective educational distribution of the labor force on an international comparison basis. The correlation was significant, but the same approach applied to an intra-national analysis showed this relationship to be very weak, and in many cases non-existent. The conclusions that we can derive from this experiment is that while the relationship exists in the aggregate, we cannot use the estimating coefficients for determining behavior, since estimates cannot be correct if the individual micro-coefficients differ. For example, if international analysis

of the data shows that 30% increase in the proportion of people with higher education in the labor force is accompanied by an increase of 50% in productivity, advocating a policy for a particular country to increase the proportion of this group in its labor force by 30% is fallacious if this relationship is not homogeneous for every country separately. Some ingredients may be missing in the casual relationship, or the international relationship may be due to a particular presentation and distribution of the data. This does not mean, of course, that the relationship is meaningless; it is useless for policy making but can still be used for limited prediction purposes.

An experiment relating productivity of each of the 2 and 3 digit industries with the distribution of education of their labor forces across countries yielded higher and statistically more meaningful correlations. These results can be applied to an aggregate such as manufacturing as a whole, as well as to the minor groups of industries separately. The fact that meaningful correlations exist for some industries across countries and not for others leads us to believe that there exists a relationship between productivity and education for each industry separately. This relationship varies from industry to industry, and is less affected by the unknown factor particular to each country than by the relationships of the aggregates of industries.

Prior analysis of occupational structures of industries and productivity shows similar results, namely: that there exists a relationship between productivity of an industry and the occupational distribution of the labor force of the same industry, and that this relationship is unique to each industry. However since the educational distribution of

the labor force in a given industry is the result of the interaction of the occupational distribution of the industry and the educational distribution of each occupation, it is very important to determine which is the weightier factor; structure of occupations or educational level of occupations.

Our analysis shows that the occupational structure is the deciding factor in determining the educational distribution of the labor force. In other words: it is the variation in the proportion of specific occupations in the total labor force rather than the variation in the years of schooling of the same occupations that is the major determinant in the variation of productivity.

This last conclusion has wide practical implications for educational planning, because it centers attention on the type as well as on the amount of education. An increase of productivity in our industry does not come about by increasing the proportion of those who have higher education in the labor force of this industry, but rather by increasing the proportion in the labor force of a specific type of higher education. If, for example, we educate our salesmen more, they will probably not affect our productivity very much, although the data will show an upward shift of the educational distribution.

This conclusion was strengthened by an intertemporal and international analysis of a large sample of 3 and 5 digit occupations.

We could not find a consistent pattern for the distribution of formal educational levels of occupations across countries as related to a variable such as income per capita. Only the extremes of the data, such as a comparison of Argentina with the U.S., show a consistent behavior.

On the other hand, an intertemporal analysis of four countries shows a consistent upward shift of the educational levels of all occupations over time. This can be explained if we assume that there is a relationship between income per capita and the level of education of an occupation ceteris paribus. This condition is usually present in the same country during the short run, in our case a decade, but not across national boundaries. A simple model developed in this paper, which introduces age as a variable, also helps explain this upward drift in the same country.

A clue to the hypothesis that every country has a different appetite for education was provided by analyzing the relationship between income per capita and the educational levels of Domestic Servants and Cleaners and Unskilled Laborers. For these groups, presumably, an increase of educational levels is more a reflection of an increase of the "consumption" of education, since very little education is needed for productive purposes. Granted that this exercise is a poor proxy for an analysis of the population as a whole, the analysis reveals a complete absence of relationship between income per capita and the educational level of these groups across national boundaries. Our analysis also shows that the most meaningful correlations between education and productivity are obtained when correlating the proportion of people with more than a secondary education with productivity. This should come as no surprise since we determined that the occupational distribution is the determining factor in the educational distribution.

We can safely assume that the professional and technical occupations form the bulk of the educational group with more than a secondary education. On the other hand

the relationship of productivity with the group with less than a secondary education is very weak. This is precisely the group that probably includes most of the manual workers, and where there are big trade-offs between formal and informal education.

From a strict production point of view, formal education is a derived demand. Namely, in order to produce a given good we need a certain amount of machinery and labor. This labor has to have a certain amount of knowledge to work efficiently with the machinery. This knowledge is mostly specialized, and, with a given combination of physical, mental, and acquired abilities, constitutes the basic ingrediants of an occupation.

Formal education is but one of the different ways of acquiring the developing these ingredients. This may explain why we could not find evidence that an increase in the proportion of secondary school graduate in the labor force increases productivity, nor that a decrease of the group with 0-8 years of schooling is related to increases of productivity. One explanation could be that most countries that comprise our sample have had at least a compulsory primary school system for the last 30 years. But this is only partially the answer. Most important is the fact that to become a semi-skilled or even a skilled worker we may not need, in many cases, more than 8 years of formal schooling, and the rest can be made up with "On the Job Training" or Apprenticeship Programs. For example, in many European countries a large proportion of those in highly skilled occupations "picked up" their skills at work, and there is no doubt that these workers are at par, as far as skills are concerned, with their counterparts in other countries where formal education may be higher.

This is not to say that the contents of jobs do not change over time, and that these changes do not tend to broaden the occupational profiles and increase the emphasis on mental work and broader knowledge, that may be easier to impart with formal schooling. But data seem to indicate that after a minimum amount of formal schooling is achieved, for most blue collar jobs a choice can be made between formal and informal training, or a combination of both.

The optimum combination of both types of training is not easy to find. It depends not only on the different actual and opportunity costs of each method and the discount rate in each case, but more important, on the structure and traditions of society. These vary from country to country and no meaningful results can be obtained by adopting the systems of education of one country in another where conditions are completely different. It makes no sense to require a machinist to have ten years of formal education because this is the level of education prevalent in many countries, if a person with ten years of education in a less developed country can earn twice as much working as a petty bureaucrat, or where the time preference is very high and, therefore, an extra year of foregone earning very expensive. On the other hand, where for some reason the average formal education of occupations is high, as in countries where compulsory school attendance lasts to a high age, the supply of education creates its own demand, and the level of formal education required by an occupation becomes higher.

The formal school plays a dual role: that of educating and selecting. These actions are intertwined and, therefore, incomes accrued to schooling do not necessarily

reflect education, but rather merely compensate for having passed the selection test. It is for this reason, among others, that comparisons of rates of return from years of schooling may be misleading. Some of the results should be labeled "rates of return for selective services."

Finally, the present use of educational distributions for analysis and planning has to be reviewed. The data as presented in Census and other sources tell the story of the labor force in the last 40 to 50 years. Any correct appraisal has to include age as an independent variable, wages, relative wages, changes in legal and social settings, and so on. This is another reason one's being careful about applying educational data from one country to another, but at the same time a new approach for the analysis of educational data, incorporating all these variables, may provide new procedures for the solution of the problem in each particular instance.

Appendix I

APPROXIMATE YEARS OF SCHOOLING EQUIVALENT TO CENSUS' CLASSIFICATIONS

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		0-4				5-8		9-11	12	13-15	16+	
U.S. 1950					0-8	8		9-11	12	13-15	16+	Not Stated
Canada 1961		0-4				5-8			9-12	13+		
Canada 1951		0-4				5-8			9-12	13+		
Norway 1960								11	12		16+	(1)
West Germany 1957							9-12		12		16+	(1)
France 1962						8	9		12		16+	Not Stated
Holland 1960				6			9	11	12	13-15	16	17+
U.K. 1961						0-8	9-10		11-13	13+		Not Stated
U.K. 1951						0-8	9-10		11-13	13+		Not Stated
Argentina 1960	0			1-6				7-11	12	13-15	16+	
Yugoslavia 1961	0-3				4-7	8		9-11	12	13-15	16+	
Japan 1960	0			6			8-9		12	13-15	16+	
Japan 1950		0-4		5-6		7-8		9-11	12	13-15	16+	

(1) Includes people with undefined formal schooling

APPENDIX II

EDUCATIONAL DISTRIBUTION OF SELECTED OCCUPATION
BY YEARS OF EDUCATION*

(per thousand)

Note: The number in a given year - column for a particular country represents the proportion per thousand of people engaged in a given occupation in this particular country that has the years of the range of years of education portrayed in the same position in Appendix I. For example, data for the occupation of "Secretaries, Stenographers, and Typists" in the U.S. 1950 should read: 13 per thousand have 0-8 years of schooling, 25 per thousand 8 years, 92 per thousand 9-11 years, 604 per thousand 12 years, and so on.

* This data is derived from M. Horowitz, M. Zymelman, E. Harrnstadt, Manpower Requirements for Planning, Statistical Tables. Northeastern University, Boston, Mass. Dec. 1966.

OCCUPATION: Bookkeeper, Cashier & Teller

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		4				77		212	518	156	33	
U.S. 1950					28	66		163	510	161	52	19
Canada 1951		3				112			714		170	
Canada 1961		3				101			654		240	
Norway 1960								31	523		5	441
West Germany 1957								583	291			126
France 1962												
Holland 1960				175			526	134	148	6	4	6
U.K. 1961												
U.K. 1951						395	171		381		8	45
Argentina 1960	9			386				264	247	78	16	
Yugoslavia 1961	2				187	362		109	2	313	26	
Japan 1960				8			173		671	57	91	
Japan 1950		5		17		196		523	86	132	41	

OCCUPATION: Secretary, Stenographer & Typist

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		1				22		114	606	207		48	
U.S. 1950					13	25		92	604	182		67	16
Canada 1951		1				45			772		182		
Canada 1961		1				40			722		235		
Norway 1960								8	538			11	443
West Germany 1957								470	382				147
France 1962													
Holland 1960				239			640	11	105			1	3
U.K. 1961						147	315		489		16		33
U.K. 1951						290	238		410		13		50
Argentina 1960	5			492				316	128	37		22	
Yugoslavia 1961	2				138	630		136		43		1	
Japan 1960				1			163		771	49		16	
Japan 1950				10		203		611	88	79		10	

OCCUPATION: Office Machine Operator

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	Other
U.S. 1960		2				56		187	605	127	22	
U.S. 1950					23	53		176	602	106	23	17
Canada 1951		2				96			793	109		
Canada 1961		2				77			748	171		
Norway 1960								30	363		3	605
West Germany 1957												
France 1962						586	182		24		5	203
Holland 1960				383			564	19	32		1	
U.K. 1961												
U.K. 1951						459	254		243	1		43
Argentina 1960	42			513				225	138	50	32	
Yugoslavia 1961	41				178	500		162	2	114	4	
Japan 1960												
Japan 1950												

OCCUPATION: Telegraph Operator

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		10				175		223	481	92	19	
U.S. 1950					77	163		231	380	103	20	26
Canada 1951		5				185			724		86	
Canada 1961		5				135			718		140	
Norway 1960								5	945		1	49
West Germany 1957												
France 1962						483	177		21		3	317
Holland 1960				314			637	12	36			
U.K. 1961												
U.K. 1951						504	242		195		2	57
Argentina 1960	8			692				208	74	14	5	
Yugoslavia 1961	18				354	393		130	4	99	2	
Japan 1960				7			449		524	16	4	
Japan 1950		2		24		489		418	31	32	3	

OCCUPATION: Postman

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		6				115		220	480	150	29	
U.S. 1950					69	139		218	400	126	32	16
Canada 1951		36				446			476	42		
Canada 1961		35				353			551	59		
Norway 1960								45	69			886
West Germany 1957												
France 1962						660	18		2		1	319
Holland 1960				385			612	2	2			
U.K. 1961						733	166		51	4		47
U.K. 1951						845	53		29	1		72
Argentina 1960	38			831				121	8	2	1	
Yugoslavia 1961	27				697	194		65	1	16		
Japan 1960				110			605		279	6		
Japan 1950		34		197		583		148	18	20		

OCCUPATION: Sales Representative & Broker

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		7				90		140	317	239		207	
U.S. 1950					55	91		140	307	211		174	23
Canada 1951		10				183			577		230		
Canada 1961		6				108			534		350		
Norway 1960								77	406			19	498
West Germany 1957								441	235				324
France 1962						389	146		117			52	296
Holland 1960				297			518	41	128	1		7	7
U.K. 1961						371	166		384		39		39
U.K. 1951						472	128		317		19		65
Argentina 1960	13			512				296	116	51		12	
Yugoslavia 1961													
Japan 1960	4			102			407		381	48		57	
Japan 1950		115		182		376		217	33	59		18	

OCCUPATION: Salesmen & Sales Assistant

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		15				172		270	336	138	70	
U.S. 1950					87	132		240	344	122	58	16
Canada 1951		14				300			614	72		
Canada 1961		16				260			616	107		
Norway 1960								29	160		1	810
West Germany 1957								440	159		22	378
France 1962						509	56		17		4	414
Holland 1960				519			459	5	16		1 1	
U.K. 1961						470	389		90	4		47
U.K. 1951												
Argentina 1960												
Yugoslavia 1961												
Japan 1960	5			110			462		363	27	34	
Japan 1950		80		159		385		291	33	43	10	

OCCUPATION: Foreman & Supervisor

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		23				272		260	310	91	45	
U.S. 1950					174	239		238	240	65	31	13
Canada 1951		49				455			432	64		
Canada 1961		42				367			480	109		
Norway 1960								589	35		76	300
West Germany 1957												
France 1962												
Holland 1960												
U.K. 1961												
U.K. 1951						814	61		67	3		56
Argentina 1960												
Yugoslavia 1961	18				396	103		376	44	61	2	
Japan 1960												
Japan 1950		34		125		377		256	56	122	30	

OCCUPATION: Farm and Garden Worker

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		176				419		241	111	42	11	
U.S. 1950					414	231		163	121	32	16	23
Canada 1951		115				539			296	50		
Canada 1961		128				552			285	33		
Norway 1960								141	15			844
West Germany 1957								82	54			864
France 1962						318	8		3		1	670
Holland 1960				490			504	4	3			
U.K. 1961						575	271		79	6		69
U.K. 1951						727	102		56	4		111
Argentina 1960	338			649				10	2			
Yugoslavia 1961												
Japan 1960	21			249			561		164	4	1	
Japan 1950		324		84		305		203	36	45	4	

OCCUPATION: Miner and Quarryman

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		124				458		210	173	30		6	
U.S. 1950					436	237		173	113	21		7	13
Canada 1951		144				582			248		26		
Canada 1961		109				504			333		52		
Norway 1960								60	13				
West Germany 1957								268	48				684
France 1962													
Holland 1960				758			220	16	5				
U.K. 1961						734	198		20		3		46
U.K. 1951						864	42		12		1		81
Argentina 1960	307			668				18	4	2		1	
Yugoslavia 1961	248				679	29		36	3	5			
Japan 1960	10			172			675		131	7		5	
Japan 1950		72		240		533		118	17	19		1	

OCCUPATION: Baker

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		71				405		277	201	37	9	
U.S. 1950					259	270		231	181	26	8	24
Canada 1951		70				566			342	22		
Canada 1961												
Norway 1960								395	40			565
West Germany 1957								689	155			165
France 1962						471	19		3		1	506
Holland 1960				483			512	1	4			
U.K. 1961						607	280		57	5		52
U.K. 1951						763	95		55	4		82
Argentina 1960												
Yugoslavia 1961												
Japan 1960	2			85			731		168	6	8	
Japan 1950		58		173		475		246	21	22	4	

OCCUPATION: Spinner and Winder

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		161				531		207	96	4		
U.S. 1950					580	172		165	74	4	5	
Canada 1951		56				676			256	12		
Canada 1961												
Norway 1960								93	23			884
West Germany 1957								142				858
France 1962						262	3		1			734
Holland 1960				815			180	3	1			
U.K. 1961						694	236		22		3	45
U.K. 1951						840	82		18		3	57
Argentina 1960												
Yugoslavia 1961												
Japan 1960	3			111			819		61	4	2	
Japan 1950		25		177		446		335	9	7		

OCCUPATION: Weaver and Loom Fixer

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		102				511		241	133	12	1	
U.S. 1950					460	217		211	87	9	4	11
Canada 1951		52				664			267	16		
Canada 1961		89				581			302	26		
Norway 1960												
West Germany 1957								342	76			582
France 1962						368	8		2		2	620
Holland 1960				710			280	7	3			
U.K. 1961						709	223		29	3		36
U.K. 1951						840	82		16	3		58
Argentina 1960												
Yugoslavia 1961												
Japan 1960	3			146			778		69	1	2	
Japan 1950		42		302		440		198	9	8	1	

OCCUPATION: Tailor and Dressmaker

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		81				428		215	206	56	14	
U.S. 1950					276	258		192	185	45	17	26
Canada 1951		86				529			355	31		
Canada 1961		76				481			371	70		
Norway 1960								212	26			762
West Germany 1957								575	108			317
France 1962						463	21		5		1	510
Holland 1960				564			423	8	5			
U.K. 1961						581	252		96	5		67
U.K. 1951						658	166		66	4		107
Argentina 1960												
Yugoslavia 1961												
Japan 1960	1			49			650		289	9	3	
Japan 1950		36		138		448		309	37	30	2	

OCCUPATION: Shoemaker, Nonfactory

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		167				458		194	146	32		3	
U.S. 1950					406	228		180	134	23		7	21
Canada 1951		179				582			224		15		
Canada 1961		184				580			211		23		
Norway 1960								213	22				765
West Germany 1957								736	167				97
France 1962						318	11		1				669
Holland 1960				788			212						
U.K. 1961						684	200		57		4		55
U.K. 1951						785	74		44		3		95
Argentina 1960													
Yugoslavia 1961													
Japan 1960													
Japan 1950		88		285		472		132	11	11			

OCCUPATION: Sawyer

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		178				471		195	133	19	3	
U.S. 1950					529	216		140	86	14	4	10
Canada 1951		151				614			224	11		
Canada 1961		148				552			278	21		
Norway 1960												
West Germany 1957								118				882
France 1962						300	11		5		1	683
Holland 1960				824			173	2	1			
U.K. 1961						629	273		42	3		52
U.K. 1951						821	91		21	2		64
Argentina 1960												
Yugoslavia 1961												
Japan 1960	3			167			671		155	3	1	
Japan 1950		66		205		519		161	21	25	2	

OCCUPATION: Upholster and Related Furniture Worker

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		42				369		303	237	41	7	
U.S. 1950					212	245		269	210	33	13	19
Canada 1951		48				521			400	31		
Canada 1961		53				490			406	49		
Norway 1960												
West Germany 1957								571	102			327
France 1962												
Holland 1960				727			265	4	4			
U.K. 1961						618	279		54	4		45
U.K. 1951						760	139		32	2		67
Argentina 1960												
Yugoslavia 1961												
Japan 1960				104			746		149			
Japan 1950		48		190		524		190			48	

OCCUPATION: Pressman and Printer

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		14				228		311	385	55	6	
U.S. 1950					165	302		51	381	63	15	23
Canada 1951		13				399			548	40		
Canada 1961												
Norway 1960								341	33		1	625
West Germany 1957								548	167			286
France 1962						507	26		7		2	459
Holland 1960				624			366	5	5			
U.K. 1961						527	343		81	4		45
U.K. 1951						573	200		164	9		55
Argentina 1960												
Yugoslavia 1961												
Japan 1960				54			608		305	16	17	
Japan 1950		22		136		489		286	28	32	6	

OCCUPATION: Moulder and Coremaker

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		89				461		251	166	30	2	
U.S. 1950					385	268		205	109	15	3	15
Canada 1951		99				612			273	16		
Canada 1961		95				571			303	29		
Norway 1960												
West Germany 1957								596				404
France 1962						305	6		1		1	688
Holland 1960				846			150	2	2			
U.K. 1961						752	184		23	2		39
U.K. 1951						849	69		18	2		62
Argentina 1960												
Yugoslavia 1961												
Japan 1960	3			97			727		167	3	3	
Japan 1950		43		193		572		150	19	21	3	

OCCUPATION: Tool and Die Maker

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		12				245		270	385	78		10	
U.S. 1950					114	228		239	330	57		16	16
Canada 1951		18				299			580		103		
Canada 1961		15				265			574		145		
Norway 1960													
West Germany 1957								690	103				207
France 1962						672	28		5			2	294
Holland 1960													
U.K. 1961						516	292		149		7		36
U.K. 1951						703	135		104		3		55
Argentina 1960													
Yugoslavia 1961													
Japan 1960													
Japan 1950		56		167		556		167	56				

OCCUPATION: Sheetmetal Worker

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		25				299		291	330	48		6	
U.S. 1950					171	225		268	273	41		8	15
Canada 1951		37				478			454		31		
Canada 1961		36				411			502		51		
Norway 1960								263	17				719
West Germany 1957								459	59				481
France 1962						530	16		3				450
Holland 1960				526			470	3	1				
U.K. 1961						588	308		56		3		45
U.K. 1951						795	111		32		1		60
Argentina 1960													
Yugoslavia 1961													
Japan 1960	1			107			725		157	6		4	
Japan 1950		76		239		523		134	15	13			

OCCUPATION: Blacksmith and Hammerman

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		99				500		205	172	21	3	
U.S. 1950					382	312		171	99	16	5	16
Canada 1951		141				621			225	13		
Canada 1961		150				560			264	24		
Norway 1960								176	18			806
West Germany 1957								656	122			222
France 1962												
Holland 1960				490			503	4	2			
U.K. 1961						780	158		21	2		40
U.K. 1951						848	60		15	2		75
Argentina 1960												
Yugoslavia 1961												
Japan 1960	5			165			668		154	7		
Japan 1950		85		235		515		128	15	20	1	

OCCUPATION: Welder and Flame Cutter

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		40				384		305	239	29		3	
U.S. 1950					201	253		287	214	28		5	12
Canada 1951		44				526			405		25		
Canada 1961		44				489			423		42		
Norway 1960								159	28				813
West Germany 1957								546	82				371
France 1962						345	9		1			1	645
Holland 1960				447			549	3	1				
U.K. 1961						623	279		47		3		48
U.K. 1951													
Argentina 1960													
Yugoslavia 1961													
Japan 1960				39			730		223	6		2	
Japan 1950		22		133		613		183	24	24			

OCCUPATION: Furnaceman and Smelter

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		91				421		263	191	30		5	
U.S. 1950					346	238		212	163	26		5	11
Canada 1951		131				569			270		30		
Canada 1961													
Norway 1960													
West Germany 1957								271					729
France 1962						291	14		3			1	690
Holland 1960				877			118	2	3				
U.K. 1961						805	118		33		4		40
U.K. 1951						879	30		19				72
Argentina 1960													
Yugoslavia 1961	90				539	43		318	5	5			
Japan 1960	1			64			646		272	9		9	
Japan 1950		21		141		602		178	31	26			

OCCUPATION: Carpenter and Joiner

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		70				409		249	222	42	8	
U.S. 1950					292	267		208	172	36	9	16
Canada 1951		112				586			280	22		
Canada 1961		113				538			312	36		
Norway 1960								171	20			809
West Germany 1957								751	125			125
France 1962						391	7		2			601
Holland 1960				123			866	7	4			
U.K. 1961						562	317		69	4		49
U.K. 1951						749	135		44	1		70
Argentina 1960												
Yugoslavia 1961												
Japan 1960	1			115			764		114	3	2	
Japan 1950		77		225		567		106	12	12	1	

OCCUPATION: Painter and Paperhanger

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		72				420		270	184	44	11	
U.S. 1950					282	257		226	164	36	12	22
Canada 1951		64				548			355	33		
Canada 1961		72				504			371	51		
Norway 1960								237	33			729
West Germany 1957								607	125			269
France 1962						347	12		2		1	638
Holland 1960				393			592	13	1			
U.K. 1961						680	224		41	3		52
U.K. 1951												
Argentina 1960	45			877				67	6	3	1	
Yugoslavia 1961												
Japan 1960	2			99			699		184	9	8	
Japan 1950		55		199		518		187	18	21	1	

OCCUPATION: Bricklayer, Stonemason and Tile Setter

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		70				370		277	231	46	6	
U.S. 1950					315	233		221	173	31	9	17
Canada 1951		95				567			314	23		
Canada 1961		119				576			274	30		
Norway 1960								219	17			763
West Germany 1957								703	94			202
France 1962												
Holland 1960				551			446	2	1			
U.K. 1961						668	242		36	4		50
U.K. 1951						821	85		21	1		72
Argentina 1960												
Yugoslavia 1961	138				687	30		142	1	2		
Japan 1960				118			738		135	4	4	
Japan 1950		106		213		511		149	21			

OCCUPATION: Electrician

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		14				231		273	378	92		11	
U.S. 1950					120	191		265	318	75		18	13
Canada 1951		20				351			549		80		
Canada 1961													
Norway 1960								454	36				510
West Germany 1957								582	137				280
France 1962						593	45		5			3	355
Holland 1960				45			933	13	8			1	
U.K. 1961						457	360		135		6		42
U.K. 1951						669	180		95		2		54
Argentina 1960	24			722				163	76	12		3	
Yugoslavia 1961	19				333	91		493	18	46		1	
Japan 1960													
Japan 1950		14		79		521		283	46	52		4	

OCCUPATION: Plumber and Pipe Fitter

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		40				340		290	280	46		5	
U.S. 1950					220	246		258	211	37		10	17
Canada 1951		44				510			418		27		
Canada 1961		43				439			474		43		
Norway 1960								283	30				687
West Germany 1957								633	133				233
France 1962						419	15		3			1	562
Holland 1960				365			624	7	4				
U.K. 1961						487	341		123		6		43
U.K. 1951						758	132		45		2		64
Argentina 1960	52			836				89	19	3		2	
Yugoslavia 1961													
Japan 1960				71			657		253	8		11	
Japan 1950		33		169		572		173	25	29			

OCCUPATION: Lineman and Cable Joiner

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		11				134		199	545	103	8	
U.S. 1950					89	126		216	454	89	15	12
Canada 1951		24				328			566	82		
Canada 1961		23				227			601	147		
Norway 1960								90	18			892
West Germany 1957												
France 1962						621	62		11		2	304
Holland 1960				416			572	8	3		1	
U.K. 1961						676	208		73	2		41
U.K. 1951						833	59		49			59
Argentina 1960												
Yugoslavia 1961												
Japan 1960				49			648		285	13	4	
Japan 1950		18		102		569		232	36	38	5	

OCCUPATION: Locomotive Engineer and Fireman

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		20				336		261	306	62		14	
U.S. 1950					194	284		236	217	42		12	15
Canada 1951		33				449			484		35		
Canada 1961		22				355			557		64		
Norway 1960								328	291				381
West Germany 1957								413	333				254
France 1962						633	32					1	334
Holland 1960													
U.K. 1961						869	29		37		3		63
U.K. 1951						861	59		18				62
Argentina 1960	31			842				103	22	1		1	
Yugoslavia 1961													
Japan 1960				10			554		426	5		5	
Japan 1950		2		19		641		284	24	28		2	

OCCUPATION: Seaman and Boatman

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		87				385		278	199	45	7	
U.S. 1950					283	208		237	191	37	10	35
Canada 1951		83				532			363	22		
Canada 1961												
Norway 1960								19	47			934
West Germany 1957												
France 1962												
Holland 1960				555			439	3	2			
U.K. 1961						493	259		84	7		157
U.K. 1951						671	95		59	2		173
Argentina 1960	86			782				88	34	4	6	
Yugoslavia 1961												
Japan 1960	4			136			691		149	10	10	
Japan 1950		85		195		538		148	13	19	2	

OCCUPATION: Dock Worker

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		175				436		230	124	29	5	
U.S. 1950					478	224		161	99	13	4	19
Canada 1951		191				596			204	9		
Canada 1961		178				536			264	20		
Norway 1960								24	43			933
West Germany 1957												
France 1962												
Holland 1960				267			717	7	7			
U.K. 1961						813	126		13	2		45
U.K. 1951						854	42		42			63
Argentina 1960												
Yugoslavia 1961	242				709	28		20		1		
Japan 1960												
Japan 1950		104		277		481		107	14	18		

OCCUPATION: Automobile Mechanic

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		44				366		298	251	37	4	
U.S. 1950					210	242		274	227	29	5	13
Canada 1951		43				515			413	29		
Canada 1961		48				462			444	44		
Norway 1960												
West Germany 1957								587	120			293
France 1962												
Holland 1960												
U.K. 1961												
U.K. 1951						683	166		85	2		63
Argentina 1960												
Yugoslavia 1961												
Japan 1960				25			680		282	10	3	
Japan 1950		11		89		570		256	32	38	5	

OCCUPATION: Radio and Electric Appliance Repairman

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		13				156		248	418	140	24	
U.S. 1950					68	102		239	408	131	36	15
Canada 1951		12				204			614	169		
Canada 1961												
Norway 1960								259	194		1	510
West Germany 1957								645	194			161
France 1962												
Holland 1960				309			614	56	19	1	1	
U.K. 1961						318	360		274	17		31
U.K. 1951						472	187		272	21		47
Argentina 1960												
Yugoslavia 1961												
Japan 1960												
Japan 1950												

OCCUPATION: Stationary Engineer

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		24				240		188	240	126	181	
U.S. 1950					198	231		189	196	76	100	11
Canada 1951		55				486			400	59		
Canada 1961		48				415			454	80		
Norway 1960								100	209		1	690
West Germany 1957												
France 1962												
Holland 1960												
U.K. 1961						754	164		35	2		45
U.K. 1951						840	43		48	3		66
Argentina 1960	78			853				51	16	1	1	
Yugoslavia 1961												
Japan 1960				86			566		313	20	14	
Japan 1950				115		538		231	38	77		

OCCUPATION: Laborer

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		174				403		244	145	28	5	
U.S. 1950					450	233		176	115	19	6	21
Canada 1951		100				655			229		16	
Canada 1961		230				561			193		15	
Norway 1960								55	109			836
West Germany 1957								81	11			908
France 1962						192	4		1			803
Holland 1960				841			154	3	1			
U.K. 1961						662	233		31		2	71
U.K. 1951						815	78		30		2	75
Argentina 1960	225			747				22	4	1		
Yugoslavia 1961	247				696	40		16		1		
Japan 1960	12			208			618		151	6	5	
Japan 1950		149		225		381		207	21	17	1	

OCCUPATION: Policeman

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		10				161		237	414	137		42	
U.S. 1950					109	180		232	327	93		41	18
Canada 1951		20				293			602		85		
Canada 1961		15				179			667		138		
Norway 1960								37	712		50		201
West Germany 1957								68	795				136
France 1962						581	70		28			23	299
Holland 1960				300			639	15	26	2		15	4
U.K. 1961						408	225		332		5		30
U.K. 1951						591	114		227	23			45
Argentina 1960													
Yugoslavia 1961													
Japan 1960				5			257		661	36		41	
Japan 1950		2		11		320		425	116	115		13	

OCCUPATION: Barber and Beautician

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		37				257		271	364	64		6	
U.S. 1950					174	201		245	295	51		13	22
Canada 1951		47				463			462		28		
Canada 1961		37				366			537		58		
Norway 1960								373	36				591
West Germany 1957								568	158				274
France 1962													
Holland 1960				572			417	5	6				
U.K. 1961						310	508		134		2		46
U.K. 1951						649	171		97		2		80
Argentina 1960	25			869				82	19	3		2	
Yugoslavia 1961	16				232	60		686	2	3		1	
Japan 1960	1			70			746		176	6		1	
Japan 1950		47		192		491		245	14	9		1	

OCCUPATION: Waiter and Bartender

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15	16	OTHER
U.S. 1960		28				281		370	252	61	8	
U.S. 1950					175	204		308	235	49	10	19
Canada 1951		66				513			388	33		
Canada 1961		41				429			470	59		
Norway 1960								25	111			864
West Germany 1957								322	80			598
France 1962						843	72		15		2	66
Holland 1960				729			256	6	8			
U.K. 1961						694	140		91	10		65
U.K. 1951						741	91		55	4		109
Argentina 1960				885				63	10	2	1	
Yugoslavia 1961												
Japan 1960	3			123			610		250	8	6	
Japan 1950		145		186		331		251	33	44	9	

OCCUPATION: Cook and Chef

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		74				41		267	196	42		7	
U.S. 1950					323	260		207	145	34		8	23
Canada 1951		138				537			297		28		
Canada 1961		113				500			334		51		
Norway 1960								21	184				795
West Germany 1957								394	106				500
France 1962						347	18		1				634
Holland 1960				712			282	3	3				
U.K. 1961						670	140		101		9		80
U.K. 1951						729	62		72		7		130
Argentina 1960													
Yugoslavia 1961	96				663	83		137	2	18			
Japan 1960													
Japan 1950		70		214		437		231	22	22		4	

OCCUPATION: Servant and Cleaner

YEARS OF EDUCATION	0	4	5	6	7	8	9	11	12	15		16	OTHER
U.S. 1960		126				438		262	136	32		5	
U.S. 1950					436	209		191	107	25		9	23
Canada 1951		93				580			301		26		
Canada 1961		49				396			440		114		
Norway 1960								8	60				931
West Germany 1957								21					979
France 1962						232	7		1				759
Holland 1960				828			160	4	7				
U.K. 1961						762	109		54		4		71
U.K. 1951						752	60		44		3		141
Argentina 1960	242			733				21	3	1			
Yugoslavia 1961	258				636	66		33		7		1	
Japan 1960	12			167			632		175	7		7	
Japan 1950		200		307		337		137	9	9			

Appendix 3

INDUSTRY TITLES	CORRESPONDING ISIC TITLES AND NUMBERS	
Agriculture, Forestry and Fishing	Agriculture, Forestry and Fishing	0
Mining and Quarrying	Mining and Quarrying	1
Construction	Construction	4
Manufacturing	Manufacturing Less Part of 242 Repair of Boots and Shoes - Cobbling; repair shops that also make footwear are included in manufacturing / Less 384 Repair of Motor Vehicle	2-3
Food and Beverages	Food Manufacturing Industries except Beverage Industries	20
	Beverage Industries	21
Tobacco and Tobacco Products	Tobacco Manufactures	22
Textile Mill Products	Manufacture of Textiles	23
Clothing and Other Fabricated Textiles	Manufacture of Wearing Apparel, except Footwear	243
	Manufacture of Made-up Textile Goods, except Wearing Apparel	244
Leather and Its Products excluding Footwear	Manufacture of Leather & Leather and Fur Products, except Footwear and Other Wearing Apparel	29
Lumber and Wood Products, including Furniture	Manufacture of Wood and Cork, except Manufacture of Furniture	25
	Manufacture of Furniture and Fixtures	26

INDUSTRY TITLES	CORRESPONDING ISIC TITLES AND NUMBERS	
Paper and Paper Products	Manufacture of Paper and Paper Products	27
Printing and Publishing	Printing, Publishing and Allied Industries	28
Rubber Products	Manufacture of Rubber Products	30
Chemicals and Chemical Products	Manufacture of Chemicals and Chemical Products	31
Petroleum and Coal Products	Manufacture of Products of Petroleum and Coal	32
Glass, Stone, and Clay Products	Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal	33
Primary Metals	Basic Metal Industries	34
Fabricated Metal Products (except Machinery)	Manufacture of Metal Products, except Machinery and Transport Equipment	35
Machinery (except Electrical)	Manufacture of Machinery, except Electrical Machinery	36
Electrical Machinery and Equipment	Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies	37
Transportation Equipment	Manufacture of Transport Equipment	38

INDUSTRY TITLES	CORRESPONDING ISIC TITLES AND NUMBERS	
Professional and Scientific Equipment	Manufacture of Professional, Scientific, Measuring and Controlling Instruments	391
	Manufacture of Photographic and Optical Goods	392
	Manufacture of Watches and Clocks	393
Utilities	Electricity, Gas, Water and Sanitary Services	5
Trade	Wholesale and Retail Trade	61
Finance, Insurance and Real Estate	Banks and Other Financial Institutions	62
	Insurance	63
	Real Estate	64
Services	Part of 242 Repair of Boots and Shoes-Cobbling, excluding Repair Shops that also make Footwear	
	Repair of Motor Vehicles	384
	Services	8

OCCUPATIONAL TITLES		CORRESPONDING ISCO TITLES
Bookkeepers, Cashiers and Tellers	2-01	Bookkeepers and Cashiers
	Part of 6-92.90	Those selling tickets on the means of transportation other than bus or train
Secretaries, Stenographers and Typists	2-11	Stenographers and Typists
Office Machine Operators	2-91	Office-Machine Operators
	6-71.40	Teleprinter Operators
Telegraph Operators	6-71.30	Telegraphers
	Part of 6-71.90	Telegraph Operators N.E.C.
Postmen	6-81	Postmen
Sales Representatives and Brokers	3-11	Insurance and Real Estate Salesmen, Salesmen of Securities and Services and Auctioneers Commercial
	3-21	Travelers and Manufactures Agents
Salesmen and Sales Assistants	3-11	Salesmen and Shop Assistants
	3-32.30	Canvesser
	3-39.30	Demonstrator
Foremen and Supervisor	6-51.15	Conductor, Railway; Pullman-Car Conductor
Farm and Garden Workers	4-11	Farm Workers N.E.C. LESS: 4-11.45 Operator, Farm Equipment (Motor Driven) (see Construction Equipment Operator 171); 4-11.75 Farm Laborer (see Laborers 205)

Miner and Quarrymen	5-01	Miners and Quarrymen LESS: those doing Laborer's work (see Laborer 205)
Baker	8-22	Bakers and Pastry Cooks
Spinner and Winder	7-02	Spinners and Winders, Textile
Weaver and Loom Fixer	7-03	Weavers, Loom Fixers and Loom Preparers LESS: 7-03.15 Beam Warpers; 7-03.35 Tapestry Makers, Hand; 7-03.50 Weaver (Lace) Machine (see Other Textile Workers 098)
Tailor and Dressmaker	7-11	Tailors, Dressmaker and Garment Makers LESS: part of 7-11.09 those making corsetry completely (see Other Clothing and Related Worker 104)
Shoemaker, Nonfactory	7-21	Shoemakers and Shoe Repairers
Sawyer	7-73.15	Sawyer, Wood, Precision
	7-73.20	Sawyer, General, Sawmill
	7-73.25	Head Sawyer, Sawmill
	7-73.30	Edge Sawyer, Sawmill
	7-73.35	Veneer Cutter
Upholsterer and Related Furniture Worker	Part of 7-16.90 7-14	Those hand-sewing upholstery - Upholsterers and Related Workers LESS: part of 7-14.90 those cutting out or making completely curtains, pelmets and furniture civers (see Other Clothing and Related Worker 104)
Pressman and Printer	8-02	Pressmen, Printing

Moulder and Coremaker	7-35	Moulders and Coremakers LESS: part of 7-35.90 those pouring molten metal into moulds, those baking or drying moulds and cones in ovens or heated chambers (see Other Metal Fabricators and Maker 152)
Tool and Die Maker	7-50.15 7-50.20 7-50.25	Toolmaker Die Maker Patternmaker (Metal) Foundry
Sheetmetal Worker	7-54	Sheetmetal Workers LESS: part of 7-54.10 Roofer (Metal), (see Other Construction Worker 172)
Blacksmith and Hammerman	7-34	Blacksmiths, Hammermen and Forgemen
Welder and Flame Cutter	7-55.80 7-56 7-59.70	Lead Burner Welders and Flame Cutters Solder, Hand
Furnaceman and Smelter	7-31 8-32.50	Furnaceman, Metal Coke Burner
Carpenter and Joiner	7-71	Carpenters and Joiners LESS: 7-71.55 Roofer (Wooden Shingles), (see Other Construction Worker 172)
Painter and Paperhanger	7-81	Painters and Paperhangers, Construction and Maintenance
Bricklayer, Stonemason and Tile Setters	7-91	Bricklayers, Stonemasons and Tile Setters
Electrician	7-61	Electricians, Electrical Repairmen and Related Electrical Workers Less:

Electrician (continued)	7-61	7-61.30 Electrician (Vehicles) (see Other Mechanic and Repairman 194); 7-61.45 Electrical Repairman (see Radio and Electrical Anpliance Repairman 193); 7-61.50 Electrical Load Dispatcher Power Station (see Other Electrical Power, Telephone and Telegraph Worker 176); 7-61.55 Electrical Switchboard Operator, Power Station (see Other Electric Power, Telephone and Telegraph Worker 176)
Plumber and Pipe Fixer	7-55	Plumbers and Pipe Fitters LESS: 7-55.80 Lead Burner (see Welder and Flame Cutter 145); part of 7-55.90 those installing hangers and brackets for supporting pipelines (see Other Construction Worker 172)
Lineman and Cable Jointer	7-65	Lineman and Cable Jointers
Locomotive Engineer and Fireman	5-99.20	Engine Driver, Mine and Quarry
	6-31	Drivers and Firemen, Railway Engine LESS: 6-31.70 Driver, Underground or Elevated Train (see Motorman 188)
Seaman and Boatman	6-11	Deck Ratings (Ship), Barge Crews and Boatmen
Dockworker	8-81.20	Longshoreman
	8-81.30	Boat Loader (Petroleum)
Automobile Mechanic	7-53.70	Mechanic-Repairman (Motor Cycles and Motorized Pedal Cycles)
	7-53.75	Mechanic-Repairman (Motor Vehicles)

Radio and Electric Appliance Repairman	7-61.45	Electrical Repairman
	7-63	Mechanics-Repairman, Radio and Television
Stationary Engineer	8-71	Operators of Stationary Engines and Related Equipment and Boiler Firemen LESS: 8-71.80 Fireman (Steam Boiler), part of 8-71.90 those tending boilers in hot water systems (see Boiler Fireman, Ashore 200)
Laborers	4-11.75	Farm Laborer
	Part of 4-2	Those doing Laborer's work
	Part of 4-3	Those doing Laborer's work
	Part of 4-4	Those doing Laborer's work
	Part of 4-41.90	Those loading logs into chutes and stacking logs preparatory to transport
	Part of 5	Those doing Laborer's work
	Part of 5-99.40	Driver, Animal-Drawn Vehicle (Mine and Quarry)
	Part of 5-99.90	Those loading cars with loose material and pushing them along haulage ways
	6-42	Drivers of Animals and Animal-Drawn Vehicles
	6-43	Drivers Propelling their Vehicles
	8-81.40	Vehicle Loader (Railway and Road Transport)
	8-81.50	Aircraft Loader
	8-81.60	Porter, Warehouse

Laborers (Continued)	8-81.90	Longshoremen and Related Freight Handlers, Other LESS: those carrying hand baggage at railway or bus stations, airports or piers (see with Servants and Clearners 223)
	8-99	Laborers N.E.C.
Policeman	9-02	Policemen and Detectives
	9-09.20	Inquiry Agent, Private
	Part of 9-09.90	Those serving summons on persons to be tried for crimes and misdemeanors or on those whose properties are to be foreclosed and those maintaining order in the courtrooms
Barber and Beautician	9-41	Barbers, Hairdressers, Beauticians and Related Workers, LESS: 9-41.70 Bath Attendant (see Other Service Workers 224)
Waiter and Bartender	9-21	Waiters, Bartenders and Related Workers/LESS: part of 9-21.90 those removing used linen and dishes from the table, those arranging tables and chairs, those washing and drying glasses and cleaning bars (see Servants and Cleaners 223)
Cook and Chef	9-12	Cooks
Servant and Cleaner	Part of 8-81.90	Those carrying hand baggage at railway or bus stations, airports or piers
	9-19.20	Maid (except Private Service)

Servant and Cleaner (Continued)	9-19.30	Maid (Private Service)
	9-19.40	Maid (Personal)
	9-19.50	Valet (Private Service)
	9-19.60	Nursemaid
	Part of 9-19.90	Those attending children in the showers and restrooms of schools and institutions; those rendering valet services to guests and employees of a hotel; those performing various tasks in the preparation of food, such as the cleaning and peeling of vegetables
	Part of 9-21.90	Those removing used linen and dishes from tables and chairs, those washing and drying glasses and cleaning bars
	9-32	Charworker, Cleaners and Related Workers LESS: 9-32.40 Chimney Sweep (see Building Caretaker 222)
	Part of 9-99.90	Those performing personal services for users of lavatories and restrooms and keeping such places clean and tidy, those carrying baggage of hotel guests and running errands for them, those cleaning and polishing shoes